CLINICAL PLACEMENTS FOR CANADIAN MEDICAL LABORATORY TECHNOLOGISTS

COSTS, BENEFITS, AND ALTERNATIVES

FINAL REPORT

A report prepared by the
Canadian Society for Medical Laboratory Science

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EXECUTIVE SUMMARY

This report presents the findings of a study conducted by the Canadian Society for Medical Laboratory Science (CSMLS) and funded by Health Canada. It sought to identify major issues relevant to the clinical education of medical laboratory technologists in Canada, including questions of costs and benefits for the process and current implementation strategies and alternatives. The study was initiated in recognition of the current challenges faced by medical laboratory programs with respect to insufficient opportunities to provide clinical education experiences for their students, and of the lack of data on medical laboratory educational practices. This study answers the following questions:

1. Which models for clinical placements are currently in use in Canadian medical laboratory science programs?
2. Do the different models for clinical placement produce discernible and significant differences in student performance as evidenced in their performance on national certification examinations and during their clinical rotations?
3. What are the costs and benefits of clinical placements in the education of Canadian medical laboratory technologists?

The study consisted of two phases: in the first, program directors of all accredited medical laboratory programs were asked to provide detailed information on their programs' curricula and clinical placement practices. For the second phase, five programs were selected to participate in written surveys sent to laboratory directors, clinical instructors and medical laboratory students at their clinical sites. A further five programs were chosen for on-site interviews with laboratory directors, clinical instructors and students in or recent graduates of their programs at each of the sites.

Ten main observations were made about clinical placements for medical laboratory technologists:

1. The clinical practicum continues to be regarded by those most closely involved in medical laboratory education as the single most critical element in the evaluation of medical laboratory students and in the preparation of competent medical laboratory technologists.
2. The process of educating medical laboratory technologists, including the role of educators in the clinical site, is greatly undervalued, underacknowledged, and under-rewarded.
3. There is an extremely large degree of variation in clinical education practices in medical laboratory programs.
4. Clinical placement practices evidence distinct and disadvantageous geographic disparities.
5. Interprofessional communication about medical laboratory education is not serving the profession's needs.
6. The clinical education of medical laboratory students is constrained by the lack of capacity, flexibility and reliability of its clinical sites.

7. Compensation of clinical sites, where it exists, exhibits poor accountability mechanisms and inequitable implementation.
8. Educational practices in the medical laboratory profession suffer from a marked lack of research foundation.
9. Laboratory work environments exhibit a declining appropriateness for clinical education of medical laboratory students.
10. The costs of clinical education are mainly immediate and tangible; the benefits are mainly delayed and intangible. Both are rarely fully elucidated in research studies. Discussions of cost often predominate. Furthermore, discussion of one without the other creates a flawed understanding of the costs and benefits.

The study identified 23 strategies that are presently being used or considered by medical laboratory programs to cope with the challenges and cost-related constraints of clinical placements for their students. The list is augmented by several alternative practices being proposed or already in use in other professions. These strategies and alternatives include:

1. keeping class sizes small
2. shortening clinical placements
3. discontinuation or downward revision of clinical places by clinical sites
4. paying clinical sites to take students
5. offering non-monetary acknowledgements of teaching responsibilities
6. centralizing responsibilities for clinical education in the educational institution
7. using simulated laboratory experiences
8. finding out-of-province or out-of-country sites.
9. sending students out as part of health professional teams
10. sending students to more than one location
11. student bursaries
12. making placements conditional on student commitment to work at a given location
13. finding *ad hoc* clinical sites for limited periods to meet short-term needs
14. using of multiple models by the same institution
15. creating new partnerships
16. offering remote sites support/resources for students
17. non-traditional scheduling
18. sharing of sites by multiple programs
19. use of private sector facilities
20. on-site student laboratories
21. staggered clinical placements
22. reorganizing clinical rotations to reflect the reality of the workplace
23. appeals for government funding.

The study included a detailed elaboration of the costs and benefits, both tangible and intangible, that were identified by participants and which was presented to study participants in a table format for their validation in an iterative process. The elements of this table were then used to construct an algorithm for appreciating the costs and benefits more clearly, taking into account the wide variations in clinical practices observed in programs across the country.

Attempts to create direct links between student performance and the models of clinical education used were hampered by the large number of confounding variables affecting the measure to be used (pass rates for programs on national certification examinations) and which became increasingly evident as the study progressed.

The report concludes with recommendations regarding clinical education for medical laboratory technologists in the areas of accountability, communication, the student/site fit, acknowledgement and research:

1. Accountability

- 1A. Targeted funding for clinical education of medical laboratory technologists
- 1B. Development of explicit structures linking health and education policy for health professions like medical laboratory science whose educational processes cross ministerial and provincial boundaries
- 1C. Improved mechanisms for tracking and fine-tuning the fit between educational programs and human resources needs to avoid surpluses and shortfalls in the workforce
- 1D. Ensuring timely responsiveness to the data collected on human resources issues.
- 1E. Creation of accountability mechanisms for use of clinical education funds paid to health care facilities
- 1F. Establishment of protocols for clinical processes that create some measure of consistency of learning experiences for students and create clear guidelines for the roles and responsibilities of teaching technologists and coordinators

2. Communication

- 2A. Improving and centralizing communication to and among medical laboratory educators and practitioners and policy makers about educational issues
- 2B. Ensuring that research relevant to professional education is communicated among medical laboratory educators and practitioners
- 2C. Creating collaborative information-sharing networks among stakeholders in the clinical education process

3. The Student/Site Fit

- 3A. Actively recruiting students from underserved areas to study in medical laboratory programs and return to their home areas for clinical education and eventual work
- 3B. Linking clinical education ‘privileges’ to post-graduation work requirements in underserved areas
- 3C. Creating satellite campuses or modified distance-education models in underserved areas for existing medical laboratory programs
- 3D. Developing long-term plans for investing in a flexible and geographically diffuse education system for medical laboratory technologists

4. Acknowledgement

- 4A. Creating a professional environment that values teaching and sharing of professional knowledge and skills by practitioners
- 4B. Encouraging/enabling clinical sites to institutionalize acknowledgement mechanisms (both material and symbolic) for teaching activities
- 4C. Creating clearer links between clinical teaching activities and the educational institution

5 Research

- 5A. Encouraging/supporting research on medical laboratory education and practice
- 5B. Creating a central database of research that will inform decision-making processes
- 5C. Ensuring that the call for research does not serve as a substitute for action

The recommendations arise from the contention made at several points in this report that provincial ministries of health and education, federal health and human resources bodies, health care institutions (public and private) and the medical laboratory profession itself are seriously under-invested in the educational preparation of medical laboratory professionals. While there is room for improvement in the strategies currently in use for clinical education (and this report explores this issue to some degree), the expertise, commitment and resources for providing this vital educational experience already exist in the field and are being eroded by the lack of financial and policy support directed to this endeavor.

INTRODUCTION

Many educators and laboratory practitioners consider the lack of sufficient clinical placements for education of medical laboratory technologists (MLTs) in Canada to be the single most crucial obstacle to addressing the current and worsening shortage of laboratory workers. The costs involved in increasing the numbers of clinical places are a major factor in resolving this issue, and yet there is a profound lack of data on this essential educational process.

This document presents a study of the costs, benefits and alternatives for clinical placements for MLTs. It begins with an explanation of the importance of this research project, it offers a critique of the existing literature on this topic, presents the methodology carried out to gather the necessary information, and concludes with the findings and recommendations generated through the research process.

As well, this research project develops a costing model for MLT clinical placement that is sufficiently specific to address current needs in the Canadian laboratory but sufficiently flexible to encompass the various models and alternatives that are in use. In the process, other data has been gathered that contributes to the information about MLT clinical education processes that is available to key stakeholders such as employers, educators, policy-makers, laboratory practitioners, and students.

This study answers the following questions:

1. Which models for clinical placements are currently in use in Canadian medical laboratory science programs?
2. Do the different models for clinical placement produce discernible and significant differences in student performance as evidenced in their performance on national certification examinations and during their clinical rotations?
3. What are the costs and benefits of clinical placements in the education of Canadian MLTs?

This report outlines the background to this study, the methodologies used to prepare it, and the various findings and recommendations that have arisen from it.

In this report, the acronym ‘MLT’ is used to denote ‘medical laboratory technologist’. Other specific terminologies are outlined in the Glossary in Appendix A. The symbol is used to indicate quoted comments of study participants.

BACKGROUND TO THE STUDY

Clinical education has long been considered an essential component of educational preparation for health professionals. It offers the student an opportunity to observe, practice, and hone hands-on technical, problem-solving and interpersonal skills in an authentic workplace setting. It prepares students for professional certification examinations, which, in the case of medical laboratory science, emphasize the validation of student competencies.

Although the nature of the experiences varies from one health profession to the next, clinical education typically involves one or more periods of on-site workplace experience (the 'practicum') following in-class ('didactic') education. The medical laboratory practicum is typically divided into five rotations in the five traditional sub-disciplines of the laboratory; each rotation is characterized by the student's movement through 'benches' at which they learn the various analytical techniques. Students begin each 'bench' experience by observing the work of an experienced technologist; this orientation phase varies in length. The student gradually assumes responsibility for some or all of the tasks associated with that bench; the speed with which this happens, and the degree to which students take on tasks depends on the length of time available for that bench/rotation, which in turn is determined by the amount of time allowed for their entire clinical experience at the site. The setting is typically known as the 'clinical site'; in the case of medical laboratoty technologists (MLTs), sites are usually laboratories that perform the array of testing that will permit students to attain the competencies specified in the professional competency profile. The assignment of a student to a clinical site is known as a 'placement'. Instruction is carried out by a medical laboratory technologist and, in most institutions, is overseen by a coordinator.

The authors of one study concluded that clinical education adds value to the clinical enterprise in the following ways:

1. fostering higher-quality clinical care;
2. improving work satisfaction;
3. facilitating students' direct contributions to clinical service;
4. improving recruitment and retention;
5. contributing to the future of health care.[1]

Laboratory training has its historical beginnings in on-the-job training in hospital laboratory settings in the early 1900s. Programs were gradually shifted to colleges and technical institutes in the 1960s and 1970s, but laboratory sites retained their responsibilities for clinical education. The nature of the resulting relationships between educational and health-related institutions and ministries is complex and, in many cases, poorly defined. A full discussion is beyond the scope of this proposal but definitely enters into the observations and

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[1] Ogrinc, G.S., Headrick, L. A., & Boex, J.R. (1999). Understanding the value added to clinical care by educational activities. *Academic Medicine*, 74(10), 1080-6.

recommendations made later in this report. Understandably, this complexity and lack of explicitness have lead to a spirited debate about funding of clinical placements for MLT students.

Contributing to the current urgency of the issue is the closure or down-sizing of a large number of medical laboratory science programs in the early and mid-1990s, which resulted in the loss of clinical placements as laboratories diverted their resources elsewhere in the absence of student training responsibilities. It appears that no provisions were made for re-instituting these places if the need arose. Furthermore, recent trends toward the privatization of laboratories and the establishment of public/private laboratory partnerships have created a 'new breed' of laboratories that do not have the tradition, the mandate, nor the budget for clinical education.

Now that a severe shortage of MLTs is evident (and increasing in severity)[2,3] educational institutions are seeking to re-open their programs or to enlarge their class sizes. The major obstacle to doing so appears to be the lack of clinical placements for their students.[4] While an educational institution may occasionally expand its first-year class size without any guarantee that its students will all find clinical placements[5] most program directors are understandably reluctant to do so. Increasing incoming class sizes without ensuring adequate clinical placements will not address workplace shortages if students cannot graduate and enter the workforce due to lack of clinical education experience. (While the loss of experienced MLTs from the profession is also an issue related to the workforce shortage that needs attention, this discussion focuses on the 'supply side' of the workforce shortage, i.e., the supply of qualified graduates of medical laboratory science programs.)

The insufficiency of clinical places appears to arise from the unwillingness or inability of laboratories to support clinical education. While much of the current debate focuses on questions about where the responsibility for funding lies, the discussions are poorly supported by empirical data on the costs and benefits associated with clinical education of MLTs. The growing shortage of MLTs in Canada is an urgent issue in need of research that can bring about a resolution to the issue of funding of clinical placements. [6]

The medical laboratory is not the only area where clinical placements are an issue. For example, the British Columbia Academic Health Council conducted a study that revealed considerable challenges to clinical education in a number of health professions.[7] This study

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[2] Davis, K. H. (2002). Medical laboratory technologists human national human resources review – 2002 Update: Nation-wide alert. *Canadian Journal of Medical Laboratory Science*, *64*(3), 100-12.
[3] Advisory Committee on Health Human Resources (ACHHR). (1999). *An environmental scan of the human resource issues affecting the medical laboratory technologists and medical radiation technologists: Final Report.* Ottawa: Health Canada.
[4] Canadian Society for Medical Laboratory Science. (2003). *Provincial government's plan to train new lab techs greeted with cautious optimism.* Hamilton ON: CSMLS.
[5] Canadian Association of Medical Laboratory Educators. (2003). Annual Meeting of the Canadian Association of Medical Laboratory Educators. June 11, 2003, Québec City, QC.
[6] Davis, K. H. (2002). Responding to the medical laboratory staffing shortage: The Canadian perspective. *Clinical Leadership & Management Review*, *16*(6), 399-407.
[7] British Columbia Academic Health Council. (2004). *Practice education survey, final report: Planning for sufficient & appropriate student placements for health professional students in BC.* Vancouver: BCAHC.

pointed to eight main causes for current difficulties: downsizing of health care staff, health care restructuring, fewer facilities and reduction in services, increased number of educational programs and students, fiscal constraints in health care, burnout of clinical educators, and the use of more less experienced part-time staff. Researchers have suggested that the workloads and market forces to which current health care institutions are subjected are destroying the learning environment of clinical education.[8,9] Government underfunding of clinical education has been pointed to as a cause of health human resources bottlenecks in health professions such as medicine.[10]

Canadian medical laboratory science programs have implemented different models and alternatives for their clinical placements (for example, laboratory simulations, split clinical rotations, multiple-site rotations, itinerant instructors, and variations in instructor:student ratios). Laboratory sub-specialties (such as cytotechnology and medical genetics) also involve variations in clinical placement. Some of these variations have been specific responses to difficulties experiences in placing students in clinical sites. There are no data available to document the types of models in use and where they have been implemented. There is also little research on the impacts of clinical education models on student performance. The limited research that *does* exist includes one study that suggests that longer placements for medical students are associated with greater acquisition of clinical knowledge[11], another that reports that clinical rotations at the end of the MLT educational experience result in better performance on certification examinations[12] and others that demonstrate that use of simulated clinical experiences for health professionals, while helpful, may also have its limitations. [13,14,15,16,17,18,19,20,21]

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[8] Irby, D. M. (2001). Where have all the preceptors gone? Erosion of the volunteer clinical faculty. *Western Journal of Medicine*, *174,* 246-7.
[9] Ludmerer, K. (2000). Curriculum reform 2000: An analysis. In M. Whitcomb (Ed.), *The education of medicine students: Ten stories of curriculum change* (pp. 11-20). New York: Milbank Memorial Fund.
[10] Jimenez, M. (2003). For sale: Prized positions at Canada's medical schools. *The Globe and Mail*, pp. A1, A13.
[11] Vosti, K. L., Bloch, D. A., & Jacobs, C. D. (1997). The relationship of clinical knowledge to months of clinical training among medical students. *Academic Medicine, 72*(4), 305-7.
[12] Stone, D. L. (1994). *An investigation of the relationship of clinical and didactic hours of medical laboratory technicians and scores on the Board of Registry examination.* Unpublished PhD thesis. Ohio University.
[13] Green, M. M., & Hiss, S. (1983). Special training under simulated stat lab conditions. *American Journal of Medical Technology, 49*(12), 899-902.
[14] Anderson, S. C. (1984). The effects of clinical simulations on error rate when error rate is an index of professional attitude. Unpublished PhD thesis. University of Washington.
[15] Baines, R. E. (1990). *A comparison of the performance of graduates of simulated and nonsimulated medical laboratory technology programs.* Unpublished EdD thesis. Albany NY: State University of New York at Albany.
[16] Fraser, E. W. (1986). Construction and use of simulations in medical technology education. Unpublished thesis. The Catholic University of America.
[17] Olesinski, R. L., Brickell, J., & Pray, M. (1998). From student laboratory to clinical environment. *Clinical Laboratory Science, 11*(3), 167-73.
[18] Hughes, I. (2001). Do computer simulations of laboratory practicals meet learning needs? *Trends in Pharmacological Sciences, 22*(2), 71-4.
[19] Treadwell, I., & Grobler, S. (2001). Students' perceptions on skills training in simulation. *Medical Teacher, 23*(5), 476-82.
[20] Clancy, J. M., Lindquist, T. J., Palik, J. F., & Johnson, L. A. (2002). A comparison of student performance in a simulation clinic and a traditional laboratory environment: Three-year results. *Journal of Dental Education, 66*(12), 1331-7.

However limited the research may be about the merits of particular models of clinical education, there is no doubt about the overall value of clinical education in the preparation of health professionals.[22] Employers consider hands-on skills to be vital in the new graduates they seek to employ.[23,24] Medical laboratory practitioners see technical competence as a particularly important part of their practice. MLTs in the United States believe that it is tacit working knowledge, acquired through at-the-bench experience, that best equips them to handle laboratory challenges competently.[25] Canadian technologists have indicated that, if they could influence current medical laboratory science curricula, they would offer even further opportunities for students to develop essential hands-on skills.[26]

It is clear that there are large gaps in the information available to Canadian laboratory stakeholders on the issue of clinical education of MLTs. However, there *is* a great deal of international research on clinical education for health professionals in general (see the Bibliography, Appendix B). Several conclusions can be drawn from this large body of research:

1. Clinical sites incur costs for clinical education. Most of these costs are readily identified by laboratory managers, particularly since many of the costs are measurable (See Table 1). Both costs and benefits are often categorized in the literature as ‘tangible’ or ‘intangible’, which appears to relate to the readiness with which their impacts can be appreciated in terms of productivity, efficiency, or dollar figures. As is evident from the lists, some of the costs and benefits are contradictory, suggesting that there are variations in perceptions about the impact of clinical education on clinical sites.
2. The major benefits of clinical education are often overlooked or minimized because they are not easily measured (see Table 1).
3. Costs for clinical education vary with a number of factors, the most significant of which appears to be the profession or specialty under consideration (and, hence, the types of experiences that are facilitated). Other factors include: length of placement, resources, and instructor:student ratio.

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[21] Scheckler, R. K. (2003). Virtual labs: A substitute for traditional labs? *International Journal of Developmental Biology*, *47*, 231-6.
[22] Ferguson, K., & Edwards, H. (1999). Providing clinical education: The relationship between health and education. In J. Higgs & H. Edwards (Eds.), *Educating beginning practitioners: Challenges for health professional education* (pp. 52-58). Oxford: Butterworth-Heinemann.
[23] Jones, M. D. (1998). *Internships for clinical laboratory scientists: The laboratory managers’ perspective of curricula for baccalaureate education, practice, and employment.* Unpublished PhD thesis. University of Arkansas.
[24] Laudicina, R. J., & Beck, S. J. (2000). Laboratory managers’ perceptions of the impact of teaching on the clinical laboratory. *Clinical Laboratory Science, 13*(3), 180-5.
[25] Scarseletta, M. (1997). The infamous ‘lab error’: Education, skill, and quality in medical technicians’ work. In S. R. Barley & J. E. Orr, *Between craft and science: Technical work in U.S. settings,* pp. 188-209. London: Cornell University Press.
[26] Grant, M. M. (2001). *Survey on the career patterns and professional experiences of Canadian medical laboratory technologists. Unpublished research findings*. Toronto: Ontario Institute for Studies in Education of the University of Toronto.

COSTS

Tangible	Intangible
Staff time	Stress
Educational materials	Frustration
Space and facilities	Loss of esteem
Accreditation	Responsibility burden
Liability, malpractice insurance	Loss of instructor productivity
Student-performed procedures	Decreased staff efficiency
Student waste	
Equipment repair	
Student costs: stipends, meals, parking, graduation, room & board, telephones	

BENEFITS

Tangible	Intangible
Student recruitment opportunities	Upgrading/PD opportunities for staff
Student contributions to workload	Improved staff performance
Increased instructor productivity	Increased prestige for site
Decreased costs for new personnel	Increased staff job satisfaction and morale
	Increased staff self-esteem
	Transferable skills of preceptors
	Higher quality of care
	Lower staff turnover
	Contribution of long-term benefits to society

Table 1: Commonly-cited costs and benefits of clinical education as culled from the relevant literature (January 2004)

Some of the available research has simply described the costs and benefits of clinical placements without suggesting how these can be quantified. Other studies have attempted to arrive at an annual per student dollar figure for a clinical placement, with some reports concluding that there is a substantial net loss for institutions providing clinical education, and others deciding that the benefits outweigh the costs. The only recent Canadian study of clinical placement costs stated that the average cost for MLTs in the province of Alberta is $34,039 per student. [27] Limitations of much of the existing research for application to medical laboratory science in Canada may involve:

1. Lack of generalizability: Many studies are so specific as to offer little applicability to other settings. For example, they may be oriented to a single profession, a single institution, a single clinical education model, or a single point in time.
2. Lack of methodological transparency and/or rigour: Some studies do not reveal the methods used to obtain data. Not only does this confound attempts by other researchers to apply or reproduce these findings, it fails to establish the validity of the methodological

[27] Hughes, E. (2003). *Medical laboratory technology: Clinical student training cost issues.* Edmonton: Northern Alberta Institute of Technology.

approach. Studies without explicit methodologies involve unknown scientific validity and are unsuitable for use in decision making about policy and funding.

3. One-sidedness: Costs and benefits of clinical education are inextricably linked. Studies oriented to cost alone, and particularly those that present a dollar figure as a *fait accompli*, often fail to consider the mitigating influences and offsetting economic benefits of clinical placements.
4. Omission of maturational and quantity-dependent factors: Research suggests that, in some departments, students make fewer demands on clinical instructors and are increasingly productive as their rotation progresses; estimates that include instructor time must keep these fluctuations in mind. In addition, cost-per-student figures may decrease as the number of students at a given site increases.
5. Restriction to a singular perspective: Many studies adopt a markedly administrative perspective on their considerations of the costs and benefits of clinical education, appealing mainly to economic aspects of managerial and policy-making interests. While this is certainly an important concern in this issue, inquiring solely into the factors affecting one interest group without acknowledging the others creates an unbalanced and potentially misleading picture of the research topic.

It is quite likely that there is a great deal of proprietary research data on clinical placements that has not been made public. There is a need for Canadian research on medical laboratory clinical placements that is current, generalizable, methodologically sound, balanced, and readily available to the key stakeholders in medical laboratory science education.

While the findings of this project do not assign responsibility for funding medical laboratory science clinical education, they inform the current debate by providing empirical data on clinical education costs, benefits and alternatives. In addition to facilitating stakeholders' discussions about funding and alternative models for clinical placements, this project addresses some of the current information gaps and research needs noted by the following bodies:

- In its report on medical laboratory science, Health Canada's Advisory Committee on Health Human Resources recommended information gathering on educational and workforce issues for MLTs; [28]
- The Standing Senate Committee on Social Affairs, Science and Technology (also known as 'The Kirby Commission'), acknowledged the dearth of information about allied health professional education and advocated increased attention to human resources issues in these professions;[29]
- The Commission on the Future of Health Care in Canada ('The Romanow Report'), despite its glaring omission of specific mention of medical laboratory science (Canada's third largest health profession), made three recommendations for information-gathering related to the education, training, supply and distribution of health professionals in Canada;[30]

[28] ACHHR. (1999). Cited above.
[29] The Standing Senate Committee on Social Affairs, Science and Technology. (2002). *Final report on the state of the health care system in Canada.* Ottawa: Health Canada.
[30] The Commission on the Future of Health Care in Canada. (2002). Building on Values: The Future of Health Care in Canada. Ottawa: The Commission on the Future of Health Care in Canada.

- The Canadian Health Services Research Foundation recommended an integrated approach to information gathering and research on health human resources issues as well as enhanced linkages among policy and decision makers, researchers, health services providers, and educators;[31]
- A stakeholder panel on human resource planning for MLTs, in its recent report to the Ontario Ministry of Health and Long Term Care, made eight recommendations: two of these advocated research on clinical education in medical laboratory science, specifically with respect to investigating alternative models for clinical education and facilitating dissemination of information about clinical education in general);[32]
- Stakeholders in allied health education have identified clinical placements as a critical issue in educating medical laboratory technologists, among other health professionals;[33]
- A recent BC report recommended that clinical placement issues be addressed through a blend of innovation and efficient use of existing resources.[34]

By contributing to informed discussions about the challenges of clinical placements, the information gathered in this proposed project may facilitate the resolution of workplace shortages due to insufficient graduates from medical laboratory science programs. The provision of a cost/benefit guidelines, along with the empirical data to support it, enables key stakeholders to speak knowledgeably about the issues without the assumptions and information gaps that may cloud current discussions. The dissemination of information about alternative models in use for clinical education of MLTs and their impacts on student performance offers data to guide educators' efforts to enhance clinical placement curricula and permit them to link the findings with the large body of literature on workplace learning.[35] What is more, the data from this project provides the foundation for further research and information-gathering processes on clinical education. Finally, the outcomes of this project may assist program directors in marketing their programs to potential clinical placement sites.

Why is it important to resolve the apparent clinical education bottleneck that is constraining medical laboratory education? Workforce shortages of medical laboratory technologists are evident and worsening, as noted earlier. Such shortages create delays in the availability of laboratory findings, which, in turn, risk delaying appropriate therapies.[36,37] Medical laboratory

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[31] Canadian Health Services Research Foundation. (2003). A roundtable on integrated health human resource planning. Ottawa: CHSRF: Ottawa.
[32] Stakeholder Panel on Human Resource Planning and Education for MLTs. (2003*). Planning and Education for Medical Laboratory Technologists in Ontario*. Toronto: Ministry of Health and Long Term Care.
[33] *Changing Entry-to-Practice Requirements in Allied Health Professions.* (2003). A meeting of stakeholders in allied health professional education. Sponsored by the Association of Canadian Community Colleges, the Canadian Association of Allied Health Programs, and the Canadian Medical Association, Toronto, October 27, 2003.
[34] Newberry, J. M. (2004). Student and resident education at Children's & Women's Health Centre of BC: Planning for increased numbers. Vancouver: Children's & Women's Health Centre of BC.
[35]For example, Smith, P. J. (2003). Workplace learning and flexible delivery. *Review of Educational Research, 73*(1), 53-88, among many others.
[36] Hilscher, R. (2000). Close up: Testing the limits. In R. Hilscher (Producer), *CBC evening news. May 1, 2000.* Toronto: Canadian Broadcasting Corporation.
[37] Statistics Canada. (2002). Changes in unmet health care needs. (Report 82-003-XIE). Ottawa: Statistics Canada.

technologists have attributed errors to understaffed laboratory environments.[38] Taking harmful shortcuts to preparing health professionals is also unwise: poorly-prepared practitioners also exact a price in health care quality, so an evidence-based rationale must be used for educational strategies and the changes made to them. The immediate resolution of the shortage of clinical placement opportunities for medical laboratory students and the creation of a stronger research base for health professional education will forestall the deterioration in the quality of health care and the increase in therapeutic costs that arise when prompt and accurate diagnostic testing is not available.

[38] Grant, M. M. (2004). Cited above.

This is not a traditional cost-benefit analysis, nor does it purport to be one. It was intended to inquire into the costs and benefits specific to the clinical education of medical laboratory technologists as seen by those most closely associated with the educational practice. This study takes a broad look at the costs and benefits of clinical education for MLTs, addresses some of the initial information gaps, and makes recommendations for action and further research. It bases its observations in these main areas: data gathered from educational institutions and clinical sites; the experiences of those most involved in the education of MLTs, i.e., lab directors, program directors, students, clinical instructors; a critical theory analysis founded in the principal investigator's experience with academic literature and work as an MLT practitioner and educator. As such, it can be considered a mixed methods project, an approach that has value in analyzing areas with a high degree of variability and which have little foundation in prior empirical data.

An extensive literature review was conducted prior to the start of the data gathering phases. This permitted the identification of information gaps, allowed for the construction of an extensive bibliography (Appendix B), contributed to creation of the questions used in the interviews and surveys, and created the foundation for the cost-benefits table (Table 1) distributed to participants in both phases of the study, and modified in an iterative process by the participants.

Phase 1

The research was conducted in two phases. The first phase consisted of gathering data about medical laboratory science clinical placement processes and some of their outcomes. The director of each of the 33 medical laboratory science programs in Canada was contacted with a mailed survey about their clinical placement procedures (this number includes specialty programs such as cytotechnology and clinical genetics as well as general medical laboratory programs). Where necessary, follow telephone conversations with program directors ensured that the information is complete. With one exception, all program directors offered information about their programs. This data gathering process was intended to create a database of the clinical placement models in use in Canadian medical laboratory science programs. As well, this data was essential for identifying the sites that were to be followed up for further research. In addition, this process permitted a preliminary validation of the existing list of costs and benefits of clinical education. Finally, it assembled information about medical laboratory science programs that is currently unavailable and which will therefore be helpful to educational and professional organizations for research, comparative, and planning purposes.

The data were tabulated using survey analysis software (Statistical Package for the Social Sciences, SPSS) and coded using both manual and computer-aided strategies. The information was reported in the Phase 1 report submitted to Health Canada in March of 2004 and is included in Appendix C of this report.

Phase 1 enabled the sorting of programs into 'models' according to the following criteria:

Model A: These institutions demonstrate a relative overall uniformity, a mid-range length of clinical placements, and the existence of an agreement between the ministries of health and education regarding compensation for clinical education. A specific goal for further inquiry into these programs included gaining a familiarity with the inter-ministerial agreement and its implications for clinical placement.

Model B: These programs incorporate simulated laboratory experiences in the didactic programs that appear to have permitted clinical placement periods that are significantly shorter than those of other programs. Inquiry into the use of simulations was thought to be a useful exercise for institutions in this model.

Model C: Programs in this model were selected for their use of staggered periods of clinical education as opposed to a traditional model that places the clinical phase at the end of the didactic phase. Further inquiry into this model permitted examining the rationales for the implications of staggered clinical placements.

Model D: These programs represent degree programs or college/university collaborative programs. They were seen to have the potential of offering some insight into the impact of degree education on clinical education for MLTs.

Model E: These programs were considered to represent 'traditional' diploma program models: relatively long clinical placement periods, no use of simulations, with a clinical placement occurring at the end of the didactic phase.

Phase 1 also confirmed that, according to directors of medical laboratory programs, the lack of sufficient numbers of clinical places for their students, their programs are unable to expand to meet demands for medical laboratory technologists in the workplace. Phase 2 was implemented to examine this educational program/clinical placement/workplace interface more closely with a view to uncovering factors associated with the identified challenges.

Phase 2

Using the data gathered from the first survey and recommendations made by program directors, ten clinical sites were identified for further investigation (two from each model identified in Phase 1). This choice took into consideration factors such as geographical location, numbers of potential participants at the sites, the completeness of the data submitted by the educational institution, and the availability of individuals to participate in the study.

Individuals at five of the identified sites (one site from each of the models) received written surveys to be completed and returned by mail. Surveys directed to one laboratory director, two clinical co-ordinators, and two students were distributed (five surveys to each site). The survey instruments are included in Appendix D. The response rate for the written survey was disappointing: of the 25 surveys distributed, only 10 respondents replied, despite the availability of multiple options for submitting survey responses and despite telephone and e-mail follow-up attempts to encourage their responses.

However, the on-site interviews (and related telephone interviews) were far more successful. Laboratory directors, clinical co-ordinators/instructors and students or former students at the five remaining sites were asked to participate in on-site interviews and observation processes. Because participants at one site had returned to geographically dispersed locations, they agreed to telephone interviews. The four remaining sites were visited by the principal investigator. Additional telephone interviews were also conducted when knowledgeable individuals were recommended by the interview participants. In all, 35 face-to-face interviews and nine telephone interviews were conducted.

Face-to-face interviews lasted 45 to 60 minutes and followed a semi-structured format (see Appendix E for an outline of the topics that were addressed). Participants signed a consent form (Appendix F) before the interview began. Two participants declined audiotaping of their interview. The remaining on-site interviews were audio-taped; the principal investigator also took field notes during the interview and observation processes. Telephone interviews were not audiotaped, but extensive notes were taken. Analysis of interview comments was conducted, in part, manually and partially through computer assisted qualitative data analysis software (QSR N6) using a grounded theory approach with a feminist perspective.[39,40] The principal investigator's experience as a medical laboratory technologist facilitated an appreciation of the issues and terminologies discussed by the participants.

The on-site interviews were highly successful. Participants were extremely cooperative and informative. They recommended other individuals for further information and supplied helpful materials beyond those initially requested. Although there were no inducements for participation, those involved expressed a great deal of interest in this study, a desire to learn more about the findings, and the hope that the study would result in an amelioration of the constraints they were experiencing in their clinical education activities. The 'modified snowball' method used for selection of clinical sites and participants could be seen as a limitation to the thoroughness of the data collection because there exists the possibility that program directors chose their 'showcase sites' or laboratory directors their best students for the interview process.

This second research phase had these main functions:

1. It allowed validation or extension of the existing list of costs and benefits (Table 1) through an iterative process, thus creating a fuller appreciation of the issue and contributing to the existing literature;
2. It collected specific data on measurable aspects of clinical education costs and benefits;
3. It identified site-specific strategies used to address challenges in implementing clinical education;
4. It gathered information on student performance and preparedness for clinical education that is not evident in students' CSMLS examination results;

[39] Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine Publishing Co.
[40] Lather, P. (1991). *Getting smart: Feminist research and pedagogy with/in the postmodern*. New York: Routledge.

5. It permitted interviewees to identify the costs and benefits that are most significant to them, thus acknowledging the perspectives of the various stakeholders in the clinical education process;
6. It collected the data using a method different from that in the first phase, permitting between-method triangulation of responses and correcting for possible methodological bias in either one method; also, the use of interviews allowed for the possibility that participants may make observations in interviews that they might not commit to paper.

It is understood that the sampling of medical laboratory programs carried out in Phase 2 cannot claim to represent the experience of every Canadian program. However, recurring responses, particularly those that have also been noted in research elsewhere, suggest themes that cross institutional and geographical boundaries, and these are reflected in the findings reported here.

FINDINGS

ISSUES AND OBSERVATIONS

This section offers a concise compilation of the major issues identified by study participants. Each main point represents a number of sub-points that are discussed in greater detail in the following section.

MAIN POINTS

1. The clinical practicum continues to be regarded by those most closely involved in medical laboratory education as the single most critical element in the evaluation of medical laboratory students and in the preparation of competent MLTs.
2. The process of educating medical laboratory technologists, including the role of educators in the clinical site, is greatly undervalued, underacknowledged, and under-rewarded.
3. There is an extremely large degree of variation in clinical education practices in medical laboratory programs.
4. Clinical placement practices evidence distinct and disadvantageous geographic disparities.
5. Interprofessional communication about medical laboratory education is not serving the profession's needs.
6. The clinical education of medical laboratory students is constrained by the lack of capacity, flexibility and reliability of its clinical sites.
7. Compensation of clinical sites, where it exists, exhibits poor accountability mechanisms and inequitable implementation.
8. Educational practices in the medical laboratory profession suffer from a marked lack of research foundation.
9. Laboratory work environments exhibit a declining appropriateness for clinical education of medical laboratory students.
10. The costs of clinical education are mainly immediate and tangible; the benefits are mainly delayed and intangible. Both are rarely fully elucidated in research studies. Discussions of cost often predominate. Furthermore, discussion of one without the other creates a flawed understanding of the costs and benefits.

DISCUSSION OF MAIN POINTS

1. **The clinical practicum continues to be regarded by those most closely involved in medical laboratory education as the single most critical element in the evaluation of medical laboratory students and in the preparation of competent medical laboratory technologists.**

> *Recruiting is an important part of the reason for teaching students, but it is not all self-serving. Serving the community is part of our role as a health care institution…. and we know that if we don't do it, nobody else will.* (laboratory director)

- *The role modeling is a critical part of the teaching/mentoring process.* (clinical co-ordinator)
- *We would die rather than give [clinical education] up.* (program director)
- *The automation exposure is vital; the patient contact and phlebotomy experience is priceless.* (program director)
- *Working and learning in real world life situations and proving competence can't be imitated in an academic institution.* (program director)
- *Expensive! Invaluable!* (program director)
- *This is what I expected when I went to college, but college wasn't like this … Teaching techs feel more like colleagues. We get to see things during our clinical placement that the college can only talk about.* (student)

2. The process of educating medical laboratory technologists is greatly undervalued, underacknowledged, and under-rewarded.

As noted in previous research[41] and seen in other health professions[42], teaching technologists absorb high levels of responsibility for teaching and mitigate the financial impact of clinical education on the laboratory. They serve as 'buffers', minimizing the disruption and loss of productivity. This practice on the part of teaching technologists increases their workload, can lead to burnout, departure from workforce, decreased productivity, and loss of teaching techs. At one institution in Québec, technologists refused to teach students because they felt their workload was too high for them to accommodate teaching responsibilities. Teaching technologists may respond to the added responsibilities of teaching by having students watch the technologists work for much of their time rather than allowing students to perform the procedure themselves. This affects the quality of the learning experience. When students do perform procedures, they require a fairly intense level of supervision; such delegation of the work does not relieve the technologist of the responsibility for the quality of the work.

Teaching technologists often do not see the benefits of their work. There are numerous aspects of their teaching work that are not acknowledged, for example, working overtime, foregoing of lunch- and break-time, the intensification of workload, their use of personal time to research student questions, and the use of personal materials to teach.

Furthermore, this buffering of the added workload of teaching complicates efforts to calculate the costs of their contributions to clinical education. Although teaching technologists may spend all day with a student, this does not mean that 100% of their salary can be attributed to teaching: they still get their work done and sometimes work overtime without pay. Their

[41] Grant, M. M. (2004). Under the microscope: 'Race', gender and class in Canadian medical laboratory science. Unpublished PhD thesis, University of Toronto, Toronto.
[42] McPherson, K. (1996). Bedside matters: The transformation of Canadian nursing, 1900-1990.Toronto: Oxford University Press.

abilities to multi-task by teaching and performing laboratory duties simultaneously and to adapt to the changing learning needs of their students complicate attempts to estimate the amount of time teaching technologists actually spend with students.

The place of teaching in the professional practice of MLTs has been poorly elucidated in the profession's traditions and documents, although the entry-level competency profile currently in development attempts to address the value of extending personal knowledge to others.[43] Whether training students is perceived as part of the job or an added responsibility/burden may arise from beliefs about the place of teaching in professional responsibilities. Teaching of medical laboratory students is rarely presented as an opportunity to contribute to the profession, to shape the profession, or to enhance one's own professional development. The benefits and importance of professional mentoring were only rarely mentioned. In addition, clinical teaching is poorly supported with opportunities for teaching technologists to learn about educational theory or strategies and clinical instructors are often not given any choice in whether they are to have teaching tasks.

This struggle originates in the limited conceptualization of educational processes in the profession: the comments of clinical instructors in this study have suggested that pre-entry education of MLTs occupies an ambiguous and undervalued position in professional practice. There appears to be a distinct dichotomy between education and laboratory practice; many MLTs view crossing the boundaries into teaching as above and beyond what is expected of everyday professional practice. (The distinctions made in workplace settings between MLTs with the titles 'clinical instructors' and those without – bench technologists who happen to teach – seem to reinforce these boundaries.) There is an apparent need to centralize education of MLT students in professional practice. The CSMLS has always maintained a strong role in educating MLTs by establishing competency profiles for educational and accreditation programs and by conducting the profession's certification examinations; its status as a voluntary professional organization to which fewer than three-quarters of Canadian MLTs belong places limits on its ability to interact with practitioners. Nonetheless, since attitudes about professional practice and education are often ingrained during entry-level preparation[44] the CSMLS occupies a position of some influence in shaping future professionals' attitudes about their own lifelong learning and their roles in fostering other's learning processes.

The shift from the apprenticeship model for educating MLTs (which took place when programs moved into community colleges in the 1960s and 1970s) involved a loss of 'teaching mentality', as described by one participant. The difficulties noted by some institutions in finding technologists willing to teach may be related to the lack of recognition accorded to this responsibility.

Only in Québec are teaching technologists officially recognized for their teaching responsibilities and in their collective agreements through salary premiums, documented salary scales and specific job descriptions. Elsewhere, teaching technologists may be

[43] Canadian Society for Medical Laboratory Science. (2004). *Competencies expected of an entry-level medical laboratory technologist: Draft 4*. Hamilton ON: CSMLS.
[44] Thomas, A. M. (1978). Learning, compulsion, and professional behavior. In P. Slayton & M. J. Trebilcock (Eds.), *The professions and public policy* (pp. 330-8). Toronto: University of Toronto Press.

compensated for personal time spent marking tests, or with credits toward continuing education courses at the affiliated educational institution. Recognition luncheons are sometimes held and some institutions apply the funds paid by educational institutions to hiring casual staff to ease the workload (although this practice seems to be rarely seen by the teaching technologists themselves). Often, whatever benefits/recognition are given to laboratory staff for their teaching are distributed among all the staff in an attempt to be ‘fair’, rather than being directed only to the teaching technologists.

Considering the importance and relatively high demands of the clinical education process, it merits greater acknowledgement, support, and research as outlined in previous research[45] and in the recommendations put forth in this report.

3. There is an extremely large degree of variation in clinical education practices in medical laboratory programs.

The differences in clinical education practices observed during this research project include the following:

- variations from one program to another in the length of clinical placement (10 to 42 weeks), evaluation mechanisms, competency-based objectives, support and resources made available to the clinical site, student preparation for clinical rotations; and reimbursement mechanisms;

- within-program variation from one site to another due to differences in clinical site test menus, workloads, physical space, and institutional policies;

- within-site variation from one department to another;

- variations among instructors resulting from their differing levels of experience, preparation for teaching responsibilities, personalities, and comfort levels with delegating responsibilities to students; some instructors teach only reluctantly because they are given no choice;

- variations in the quality of learning experiences reported by students: some programs exhibit a lack of procedures/protocols/guidelines for teaching, so student learn through largely idiosyncratic strategies. Some students spend more time watching than performing procedures; they agree that they learn more in the latter case. Some institutions already have checklists in place for teaching protocols and strategies but these are unevenly implemented, even within the same program where clinical sites are ostensibly using the same checklists. Students at clinical sites affiliated with universities and large health centres may be exposed to a greater variety of procedures and to more unusual patient cases than are those assigned to smaller centres. Students note that they have more positive learning experiences when their instructors appear to enjoy teaching and

[45] Council of University Teaching Hospitals. (2001). Strategy paper: Models and best practices in recognizing and supporting preceptors and mentors. COUTH: Vancouver.

interacting with students. The extent to which teaching technologists are prepared for their teaching responsibilities varies widely; some teaching technologists would feel more comfortable with their roles if they had more support from educational institutions.

This clinical site permits students to do many procedures hands-on but other sites have a 'watch and learn' approach to student involvement that is boring and not helpful for learning…Mock specimens are not good for learning, either. (student)

- differences in terminology: the use of terms such as 'clinical practicum', 'clinical placement', and 'rotation', among others, show subtle variations and are further challenged by the introduction of francophone terminologies etc.

- variations in nomenclature and responsibilities of educational institutions, clinical coordinators, clinical instructors, and teaching technologists. No fewer than 11 terms are used to describe individuals who are associated with clinical education (for example, 'preceptor', 'mentor', 'clinical instructor', and 'teaching tech', among others) and the same titles are not necessarily defined in the same way in any two institutions. As well, the assignment of clinical coordinators may be decentralized to some degree (where the clinical coordinator or multiple coordinators are employees of the clinical site and/or bench techs share in teaching responsibilities) or quite centralized (where clinical coordinators are employees of the educational institution who travel to clinical sites). In some programs, the educational institution provides all evaluation materials and services for the students, while in others, the technologists at the clinical sites perform some or all of these duties.

Such differences among medical laboratory programs arise from historical differences and the efforts of educational programs to cope with local/regional/provincial policy. These differences are not necessarily problematic in themselves. In fact, they can be credited with creating a number of positive and innovative learning situations in the profession, some of which are described later in this report. Indeed, the Canadian Association of Medical Laboratory Educators has acknowledged the need to adopt a variety of models that are responsive to local needs.[46] However, if this diversity arises from lack of communication or a lack of knowledge about the effectiveness of various strategies, it merits requires further research. For example, it might be reasonable to question the variation between 10- and 42-week clinical practica among Canadian medical laboratory programs.

The variation observed among programs arises from and is exacerbated by fragmented mechanisms for implementing health professional education across the country and from programmatic responsiveness to local needs and constraints. Indeed, the original mandate of the Canadian community colleges in which most medical laboratory programs are located included this type of responsiveness. However, not all variations arise from such flexibility and innovations; some reflect a simple lack of communication among those purportedly working toward similar goals. While this research project is not intended to recommend a one-size-fits-all approach to clinical education of medical laboratory technologists, the wide variation in programs and implementation of clinical education processes and the apparent

[46] CAMLE. (2004). Minutes of the Annual General Meeting, June 12, 2004, Saskatoon, Canada.

lack of familiarity of medical laboratory educators with the differences among programs suggest that there are lost opportunities for considering best practices and creating a certain level of consistency among programs. With few exceptions, educational institutions function on rather solitary lines, conducting proprietary research and failing to support their educators in maintaining professional networking opportunities. The lack of research in the medical laboratory profession is addressed in a later point in this section.

- *Some clinical sites create unnecessary costs by setting up competency challenges rather than evaluating student performance during normal workflow or by repeating specimen tests rather than letting the student complete the test under supervision the first time.* (program director)

These and other differences in the implementation of clinical education for medical laboratory students complicate attempts to arrive at dollar figures for clinical education. It is a considerable challenge to create a national portrait from widely divergent clinical education strategies.

As a final point, it should be mentioned that although there are many ways in which medical laboratory programs differ and that these variations have existed throughout the profession's history, the use of a national competency-based examination establish an equivalency of outcomes to ensure that program graduates meet professional standards of competence.

4. Clinical placement practices evidence distinct and sometimes disadvantageous geographic disparities.

Closures of large numbers of medical laboratory programs in the 1980s and 1990s concentrated the responsibilities for supplying the nations MLTs in a small number of programs, most of which are in urban settings. These programs appear to draw their students largely from surrounding urban areas. Most or many of these students would prefer to train and eventually work close to their homes. As a result, urban sites in proximity to programs are in demand whereas other areas, particularly rural sites, are underserved and may experience acute shortages of qualified candidates for available staff positions. The original mandate of community colleges was to meet local needs. This is not being carried out by the few remaining MLT programs: the centralization and regionalization of MLT programs means that provision of practitioners is confined to certain geographical locations. There is a need to create effective strategies for ensuring that it is not just urban students who can enter programs, only to meet needs of urban centres for MLTs once they graduate.

Rural sites for clinical education present challenges: regionalization/amalgamation trends have reduced the numbers of sites that offer the array of procedures necessary for MLT students to be fully trained. These sites may not necessarily offer the fully array of laboratory procedures to which students should be exposed in order to ensure that they meet minimum competency standards. In addition, placement of students in sites remote to the educational institution create increased clinical education costs in terms of preceptor time/travel and the need for support and educational resources. Students themselves are reluctant to take clinical placements at sites far from their homes and families and often have difficulty with the expenses and logistics of relocation.

Even where full laboratory test menus and positive student experiences are available, clinical sites that are not geographically close to medical laboratory programs may have difficulty filling all their places. Program administrators may prefer not to take any more students at the start of program than they have clinical places; attrition cuts down the eventual class size needing placements, and out-of-town clinical sites are often left without a full complement of students to train. It is difficult to get students to travel to sites away from the college institution town. In addition, students may be less likely to stay at a clinical site that is not their home town after they graduate.

Larger urban sites provide more clinical education than do rural sites and thus take on a greater portion of the related responsibilities and costs. However, they also benefit from a larger student pool from which to draw potential employees.

Students face hardships in moving far from home to either train or work far from their home towns.

Prior observations about the westward migration of MLTs[47,48] suggest that programs in eastern Canada may be subsidizing the preparation of MLTs for more westerly markets (with the probable exception of Québec which could be considered one of several Canadian economic micro-environments in terms of the preparation of MLTs). There is a need for further data on the dynamic factors of the labour market, including the movement of workers from one area of the country to another as well as the related socioeconomic factors that influence such movements and their implications for labour force shortages. Provincial mechanisms for dealing with policy related to health and education do not lend themselves to a macro-level (i.e., national) appreciation of these issues.

5. Intraprofessional communication about medical laboratory education is not serving the profession's needs.

Poor communication mechanisms compound the variability observed in medical laboratory programs and educational processes. Current patterns/levels of communication among MLT educators have not afforded them the opportunity to learn from their colleagues. This appears to be working against programs, creating silos, preventing information sharing, inhibiting discussions of best practices, standing in the way of standardization, and hindering effective lobbying for needed change. The only body in place to encourage MLT educators to share information, the Canadian Association of Medical Laboratory Educators, has struggled for continuing existence and goes largely unsupported and unacknowledged by the MLT community at large. Enhanced communication will facilitate sharing of information and may

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[47] CSMLS. (2001). New grad employment picture – outlook optimistic. *Canadian Journal of Medical Laboratory Science, 63*(2), 56-8.
[48] Grant, M. M. (2001). Cited above.

enable some *rapprochement* of terminologies, standards and practices that are now so widely divergent.

Specifically, communication between educational institutions and clinical sites, and educational institutions and their students placed at clinical sites, would benefit from improvement. Students report that their feedback is not addressed promptly by their educational institution, that they do not feel that the educational institution is in touch with what is happening at the clinical site, and that a number of aspects of the didactic education does not reflect what is happening in the ‘real’ world.

- *Teachers at the college need to listen more to students and act on what the students say ... maybe with an end of year debrief about what’s not working.* (laboratory director)

- *A lot of college teachers are not good teachers because they are not knowledgeable … they are too theory-based and their theory is out of date … there’s too much from the 70s … they don’t know what’s happening at the clinical site … They say things like “It’s all going to come together” … and it does eventually in the laboratory … but I would increase the integration of theory and practice right from the start.* (student)

6. The clinical education of medical laboratory students is constrained by the lack of capacity, flexibility and reliability of its clinical sites.

Medical laboratory programs have found it necessary to modify both the didactic and clinical portions of their programs in order to adapt to the constraints imposed by their affiliated clinical sites. Some sites have refused to take students at all or have cut back on the number of students they will accommodate (due to insufficient staff, laboratory closures, renovations or relocations). Despite the likelihood of student attrition, medical laboratory program directors are reluctant to take on more students than the number of clinical places because they feel they cannot count on their clinical places from one year to the next.

- *Some sites want to withdraw while students are still there. We always find enough places but the time, effort and stress involved is phenomenal.* (program director)

- *Affiliated hospitals adjust the numbers of students that they are able to train on a yearly basis, depending on their internal circumstances (e.g., laboratory renovations, implementation of computer systems, staff shortages, etc.) A major impact on the number of clinical spaces has been the recent merger of four hospital sites into one center. The constant state of reorganization of services across these four sites has caused great instability in the number of students that [our program] is able to train. These fluctuations create a problem in planning our enrollments, since they occur sometimes with very little advance notice.* (program director)

In some cases, some clinical places go unfilled because the program has experienced an unexpected level of attrition or because, given a choice, students choose not to go to certain sites. Due to the unreliable nature of the placement agreements, program directors find themselves in the position of under-filling their programs in order to be sure they don't have more students than they can place in clinical sites. Given the current and predicted shortages of medical laboratory technologists, under-filled programs are an enormous lost opportunity. Reliable placements in clinical sites are essential to easing workforce shortages.

It should be noted that not all clinical sites are refusing to take more students; two of the sites visited in this study are actually seeking more students but are unable to do so because the educational programs with which they are affiliated cannot supply them.

7. Compensation of clinical sites, where it exists, exhibits poor accountability mechanisms and inequitable implementation.

As has been noted earlier and as will be discussed later in this report, compensation mechanisms vary widely, from none at all to provision of educational services by educational programs to fixed transfers of funds calculated according to a per week/per student sum; some are embedded in inter-ministerial agreements, others arise from agreements between health facilities and educational institutions; some have been documented, others arise from undocumented tradition with untraceable origins. Many have not been updated in years. Individuals who administer these agreements, where they exist, are unfamiliar with their origins or their relevance to current conditions. Few institutions have carried out research on the costs of the educational services they provide or for which they pay other providers.

In general, compensation of clinical sites appears both to be insufficient and/or to be directed to areas other than the laboratory where the costs are incurred. There is a marked lack of accountability on the parts of most of the stakeholders involved in the education of medical laboratory technologists. These include:

- ministries and departments of health and education: the responsibility for the costs of clinical education of health professionals has traditionally suffered from long periods of benign neglect punctuated by rash, long overdue and poorly implemented short-term measures; with the exception of the province of Quebec, explicit funding formulae and mechanisms that are responsive to clinical education contexts do not exist; provincial ministries either decline the responsibility for such expenses or participate in protracted studies to examine the 'situation'; current problems with clinical placements have their origins in mistaken policy decisions that have not considered demographic changes and the long-term implications for the actions; government has demonstrated insufficient accountability and responsibility for the costs of clinical education of health professionals; complicating this picture is the ambiguity of federal and provincial roles in health and education; the lines of communication between provincial and federal bodies are inconsistent and sometimes strained. Funding strategies vary from one province to another; some are ad hoc. The gradual shift of MLT education from apprenticeship model to a postsecondary institutionalized model has been incomplete. When Canadian community colleges took on the programs (mainly in the 1960s and 1970s) they neglected to assume responsibility for the clinical education portion of the educational experience. The poorly elucidated funding patterns persist today, despite the graduate and apparent assumption of responsibilities for organization and evaluation by college programs. Clinical education resembles the co-operative programs now in place at high schools, colleges and universities across the country; how are these administered and funded? How can those models already in place inform the debates about funding of clinical placements for health professionals? When responsibility is historically ill-defined, it is easy for no-one to accept the responsibility. The unclear boundaries regarding the costs of medical laboratory education must be clarified, including clear, unequivocal assignment of responsibility for health professional education.

> *One could say that the ministers of health and education don't get along very well.* (program director)

- health facilities: institutions that receive funds for clinical education are seldom asked to account for the disposition of these funds. Although it is the laboratory that incurs the major expenses, funds often 'disappear' into a global pot. Compensation paid by educational institutions ostensibly to partially cover the costs of replacement staff, continuing education opportunities or educational materials, may not be used for these purposes. And, as mentioned earlier, those who take on the bulk of the teaching work and responsibilities rarely see concrete benefits commensurate with the efforts they have invested;

- employers at institutions other than clinical sites: in most provinces, provincial ministries of health are the major employers of medical laboratory technologists; however, significant drains on the medical laboratory workforce result from the employment of MLTs by private and/or non-clinical employers; yet, with the exception of the province of Alberta, these beneficiaries of costly public education processes rarely contribute to the expenses involved in educating their workforce; the lack of an education tradition among private institutions and increasing privatization trends suggest that private employers are successfully avoiding responsibility for education of their employers while public education and health ministries are bearing the full costs;

- educational institutions: it appears appropriate to propose the need for standardization of clinical education protocols for education processes and compensation mechanisms (in collaboration with the clinical site) across clinical sites and possibly even across the profession; in fact, it may even be seen as fiscally irresponsible for educational institutions and other payers to be compensating sites for carrying out clinical education in the absence of any accountability mechanisms or research to support the funds expected and in the absence of any assurance that the funds are being directed to the appropriate recipients.

- CSMLS: despite the voluntary nature of membership in the national professional association and the resulting incompleteness of its membership *vis à vis* the total MLT population in Canada, the CSMLS is in a good, yet underexplored, position to take a leadership role in processes that would contribute to standardization and accountability mechanisms in clinical education.

The establishment of explicit accountability mechanisms for the education of medical laboratory technologists in general, and for funding in particular, is a major recommendation of this report.

8. Educational practices in the medical laboratory profession suffer from a marked lack of research foundation.

As noted in the introduction, the medical laboratory profession suffers from an acute lack of a research foundation for many aspects of its professional practice, including entry-level education with the exception. Educational institutions do conduct institutionally-focussed research but, unfortunately, their findings tend to go unshared with the professional and educational community at large.

Few labs appear to keep data on costs of clinical placements; almost no individuals have knowledge of any studies; it would appear that decisions are being made without the necessary supporting data. In addition, a lack of a research tradition among MLTs and educators hampers the creation and dissemination of knowledge about educational practices. This lack of research tradition arises from the diploma-based entry-level education as the professional foundation and the resulting lack of familiarity among its practitioners with research practices. Furthermore, government agencies have been somewhat remiss in their approaches to research on health professions in general and on clinical placements in particular. Not only is little attention paid to supporting inquiry into educational processes that occur outside of university settings or to supporting research by individuals/organizations that do not have a university base, but there are numerous studies prepared for government agencies that have gone unacknowledged and unreleased. The dearth of research into education and the lack of data available for studies such as this one speak to the need to gather more information about this and other health professions that do not fall within the well-researched and well-funded areas of medicine and nursing. A marked absence of research on MLT education in Canada leaves these questions largely unanswered and unshared with the profession.

The need for research is not just a matter of gathering more data but of research on pedagogical foundations for and the soundness of current and new strategies; many of the changes made to educational programs have been driven by a necessity to accommodate external conditions rather than by sound evidence; given the emphasis placed on evidence-based practices in health and health policy, medical laboratory education practices remain largely unvalidated by traditional research strategies.

However, the stated need for research (‘evidence based processes’) often appears to serve as a substitute for needed action and as a rationale for overlooking the experiences of those who are most familiar with the processes of interest. One need only consider the number of research studies commissioned and ignored by government agencies over the years to appreciate the wasteful research practices that have paralysed what should be a decisive process. Among experienced researchers, qualitative (i.e., narrative and experience-based) research is considered to be as valid as quantitative data and yet this type of input is repeatedly overlooked. This report addresses that omission by creating a practitioner-level portrait of the challenges of clinical placements. Nonetheless, it will be a wasted effort if decisive action is not taken as a result. There is no point in collecting any data at all if there is no commitment to acting on it.

9. Laboratory work environments exhibit a declining appropriateness for clinical education of medical laboratory students.

Laboratory restructuring has had (and continues to have) a major negative impact on the availability of clinical sites and on the quality of experiences for those teaching and learning in the health care setting. Changes to laboratories (and to educational programs, as well) have undermined what was a highly effective and efficient system of educating competent medical laboratory technologists. Now, laboratories have little capacity to adapt to new demands for student training.

Laboratory system restructuring measures such as privatization have resulted in a sequestration of relevant information on provincial health professional human resources issues. Private institutions are under no obligation to support public health care measures by communicating information about their services nor are their mandates necessarily in the interest of the well-being of public health care delivery. Attempts to establish health information networks may run into obstacles if information sharing is not seen by corporate entities as in their best interests.

There are few desirable jobs available for new graduates of programs. Laboratories hoping to hire outstanding students to their staff often have only casual or temporary positions to offer, which may not be sufficient to attract future employees. Although these less desirable positions sometimes permit new employees to move into more secure positions later, students may be reluctant to accept them. This is a particular challenge for clinical sites remote to the student's home town; once students leave their clinical centre it is difficult to get them to come back once they begin to look elsewhere. Timing is important; if positions are not available when students graduate, they leave town. Sites lose worthwhile students because there are no desirable full-time positions to offer them. The lack of attractive positions to offer students and the relative inflexibility of staffing structures at clinical sites, pose a problem for institutions hoping to retain good students as staff members.

- *Sometimes (new graduates) are reluctant to take on anything that's not a full time job. … If a student can go elsewhere and get a full time job, they'll do that rather than wait for a job here. … The lack of full time jobs is the biggest constraint [to hiring students after they graduate].* (laboratory director)

- *I feel that I was misled about the job opportunities in this profession… I did not get enough help with job hunting. I felt abandoned by the college.* (student)

- *We would hire back ALL of our students if we could.* (clinical co-ordinator)

Laboratory changes have resulted in a loss of individuals in middle management who used to take on responsibilities for teaching/scheduling; there is less flexibility in assigning teaching responsibilities and teaching technologists may feel coerced into teaching because there are few staff members available to perform these tasks. Impending retirements in large numbers of the aging medical laboratory profession[49,50] will deplete the workforce of its experienced practitioners and educators, making clinical education increasingly difficult to fit into an already intense workday for those who remain.

Continuing restructuring/rationalization of health facilities leads to an unstable placement situation and prevents programs from expanding their student class sizes with confidence; clinical sites have been known to withdraw their site at short notice creating major difficulties for students and programs that have counted on that training experience. The increasing rationalization of health care services according to market forces has turned clinical education of health professional students into a poorly-valued commodity and caused a deterioration of the learning environment.[51] Regionalization and resulting shifting of procedures to centralized locations make it more difficult for students to obtain the required competencies at one site and necessitate considerations of other types of institutions or other models of placement; placement at multiple sites can be a hardship for students, particularly if they are in different cities or towns.

Laboratory restructuring has necessitated changes to the didactic portions of medical laboratory programs.[52] Changes in the laboratory setting exert a 'ripple effect' on programs, necessitating time consuming and costly adjustments in how programs are offered.

Workload levels for medical laboratory technologists have increased in the past decade.[53] This has had a negative impact on clinical education: it leads to increased work-related stress, refusal to take students, declining quality of learning experience for students (although students do express appreciation for their experience of authentic levels of workload); where MLTs once were able to absorb teaching workloads, intensification of work in recent years, increased work volumes, etc. make this impossible and may compromise patient safety; the increased use of casual staff (who are often not suitable/available for training students) has placed increased teaching load on full-time technologists. The deterioration of the work environment compromises not only the quality of the work experience but of the learning experience as well.

There appears to be limited capacity at present sites for expanding the number of students they can take. This arises from the limited staff available for teaching and from space

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[49] Canadian Society for Medical Laboratory Science. (2001). Medical laboratory technologists national human resources review: A call for action. Hamilton: CSMLS.
[50] Advisory Committee on Health Human Resources. (1999). An environmental scan of the human resource issues affecting the medical laboratory technologists and medical radiation technologists: Final. Ottawa: Health Canada.
[51] Ludmerer, K. (2000). Curriculum reform 2000: An analysis. In M. Whitcomb (Ed.), *The education of medicine students: Ten stories of curriculum change*, pp. 11-20. New York: Milbank Memorial Fund.
[52] Heads of Ontario Medical Laboratory Programs. (2004). Annual meeting, August 26, 2004, Toronto, Ontario.
[53] Grant (2004). Cited above.

restrictions. When laboratories were redesigned and restructured, teaching needs were rarely considered.

10. The costs of clinical education are mainly immediate and tangible; the benefits are mainly delayed and intangible. Both are rarely fully elucidated in research studies; discussions of cost often predominate. Furthermore, discussion of one without the other creates a flawed understanding of the costs and benefits.

Clinical education of competent medical laboratory practitioners is a costly process. It also offers enormous benefits. Both aspects are more extensive and more complex than commonly acknowledged in most studies.

Perceptions of the impact of clinical placements vary widely and seem to be somewhat dependent on individual perspectives: many of the ‘official’ discussions about clinical education focus only on the costs (and on the costs to clinical sites to the exclusion of costs for any other stakeholders), but those more closely associated with it are more likely to perceive benefits and to believe that benefits offset the costs to some degree; some participants in this study expressed the belief that benefits may actually outweigh the costs; it is possible, then, that costs to labs/hospitals may be overestimated in some cases and that costs to those doing the teaching are under-estimated; Because of the way in which many discussions of the costs of clinical education are structured, the costs may be overestimated and the benefits underestimated.

It is difficult to pin down costs because (1) they are time dependent, i.e., high at startup of the clinical education program, at the start of each rotation for each student, and high at the start of a new bench. (2) they vary with the instructional strategies used by the individual teaching technologists: i.e., watch and learn vs. watch and do approaches, or with the level of educational intervention such as tests, meetings, degree of contact with instructors; (3) they may involve multiple levels of personnel at varying levels of seniority and experience (and hence, salary) at multiple institutions, but in institutionally idiosyncratic patterns; (4) they vary from department to department, for example, with the use of ‘mock’ procedures and related materials in some and not in others; (5) they depend on the number of students: multiple students in one department may require less total time from teaching technologists; and (6) as mentioned earlier, teaching technologists mitigate the costs experienced by their employers because of technologists’ assumption of extra workloads and teaching-related responsibilities.

The issues identified in these ten points are addressed in the recommendations made later in this report. It is important to acknowledge, as well, the ‘non-issues’ identified in this study: specifically, the matter of degree entry, although controversial and of great interest to the medical laboratory profession, appears not to have a bearing on clinical placements. Clinical instructors consulted in this study reported that degree and diploma students receive the same at-the-bench instruction, behave similarly during clinical their education process, and require equal opportunities to integrate theory with practice. (It is the depth of this theory background that appears to differ, according to clinical instructors.) This is not to say that there is no difference between degree- and diploma-prepared students (occasional differences in maturity and self-discipline among the two types of students were noted) but that clinical education is equally relevant to both and that the two program models do not appear to affect the length of clinical education that is perceived as valuable or necessary to result in competent practitioners. While degree entry has been cited as a *potential* threat to restoring an adequate medical laboratory workforce (because of the longer program length), the *actual* bottleneck is the lack of clinical places for students. The delay in resolving this issue is a significant human resources matter independent of degree entry; the two should not be confused. Medical laboratory technologists require clinical education, regardless of the nature of their educational program.

SUMMARY

In conclusion to this section, the costs of clinical education are borne at some point in the system: ill-advised attempts to decrease costs may result in related costs cropping up elsewhere in the system in terms of declining quality of patient care, rising need for error detection/correction mechanisms, the need for more extensive employee orientation and training. The most effective mechanisms to address current challenges of clinical education may not be so much a matter of cutting costs as assigning them most equitably, effectively and efficiently among the various stakeholders in the process.

STRATEGIES, ALTERNATIVES, AND INNOVATIONS

While the initial criteria for selection of sites to be studied were based on the five main models described in the ‘Methodologies’ section, the more detailed inquiry enabled by interviews and Phase 2 surveys revealed a large number of strategies that are presently being used by medical laboratory programs to cope with the challenges and cost-related constraints of clinical placements for their students. These various strategies are independent of the five identified models. The list is augmented by several practices being proposed or already in use in other professions. The accompanying commentary for each has shaped the series of recommendations that concludes this report. These strategies and alternatives include:

1. keeping class sizes small
2. shortening clinical placements
3. discontinuation or reduction of clinical places by clinical sites
4. paying clinical sites to take students
5. offering non-monetary acknowledgements of teaching responsibilities
6. centralizing responsibilities for clinical education in the educational institution
7. using simulated laboratory experiences
8. finding out-of-province or out-of-country sites.
9. sending students out as part of health professional teams
10. sending students to more than one location
11. student bursaries
12. making placements conditional on student commitment to work at a given location
13. finding *ad hoc* clinical sites for limited periods to meet short-term needs
14. using of multiple models by the same institution
15. creating new partnerships
16. offering remote sites support/resources for students
17. non-traditional scheduling
18. sharing of sites by multiple programs
19. use of private sector facilities
20. on-site student laboratories
21. staggered clinical placements
22. reorganizing clinical rotations to reflect the reality of the workplace
23. appeals for government funding.

A discussion of these items in greater detail follows.

DISCUSSION OF STRATEGIES AND ALTERNATIVES

1. Keeping class sizes small

An understandable and logical strategy in the absence of sufficient reliable clinical places for medical laboratory students, this step does not address the need for programs to increase the number of graduates in order to meet growing workforce shortages of MLTs. Medical laboratory programs are loathe to accept more students to their program than they can reasonably expect to accommodate for clinical education, and may face censure by the program accreditation body[54] for doing so. Program directors face the dilemma of demands for more MLT graduates for the workplace and the declining capacity for the prerequisite training in the workplace. However, even among programs that have not increased their class sizes, there are still considerable difficulties organizing and maintaining reliable clinical experiences for students. The unpredictable and often high attrition rates in medical laboratory programs complicate planning for class sizes even further.

2. Shortening clinical placements

Decreasing the number of weeks students spend at the clinical site is a commonly-used strategy for cutting down on the demands on the clinical site (and, presumably, on the associated costs). The lengths of clinical placements currently in use (ranging from 10 to 42 weeks) all represent fewer months of clinical training than were in existence when the respective programs were created. Some of these abbreviated programs are accompanied by the implementation of simulated laboratory experiences (to be discussed below).

However, there is no research to support the use of any particular length of time for clinical training of medical laboratory technologists. It is not possible to state how much clinical education is too much or too little. Of the students consulted in this study, none felt that their clinical placement was too long, but some students from the shorter programs expressed the desire to have had more time in the clinical setting prior to their completion of the program. They commented that they needed more time in particular rotations. Several program directors of programs with longer clinical placements recommended shortening the practicum periods. Several program directors, including one director of a bridging program for internationally-trained students, felt the need for longer clinical placements. Clinical instructors noted that students in shorter placements miss out on certain valuable experiences, such as time spent in specialty laboratories or participation in institutional events such as rounds, teleconferences or workshops. They found that there wasn't enough time to offer remediation or correct any shortcomings; they wanted to have time to go into more depth in some cases or to give the students some opportunities to conduct non-mandatory test procedures. Clinical instructors involved in shorter clinical placements were also more likely than others to see clinical education as stressful and as a burdensome departure from 'normal' laboratory routine.

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[54] Conjoint Accreditation Committee, Canadian Medical Association, Ottawa ON. Online. Accessed September 25 2004. http://www.cma.ca/index.cfm/ci_id/19316/la_id/1.htm

Finally, it is important to emphasize that shorter clinical placements mean that the time spent by students in the laboratory is fairly intense for the students and operates at a considerable level of disruption for the laboratory for the time students are in the site. Students do not get to the point where they can contribute to laboratory productivity to any appreciable extent. As a result, institutions with shorter clinical placement periods may not actually see productivity of students because students are removed from the bench at the point where they may be starting to make a measurable contribution to easing the workload. What happens is that the overall cost per week of short placements is higher than the cost per week of longer placements when the benefits of student presence are considered. A short placement period thus increases the apparent costs, disruption and stress associated with training without realizing many of the benefits.

3. Discontinuation or reduction of clinical places by clinical sites

This strategy takes a number of forms: it may be a permanent or temporary cessation of teaching responsibilities; it may apply to all teaching commitments, or may be a withdrawal of teaching within one or more areas of the site. It can occur after students have been accepted into the didactic program in numbers based on the availability of the site in question. Such discontinuations may result from laboratory closures, downsizing, or renovations, from refusal by laboratory staff to take on teaching responsibilities due to high workload, or from a lack of sufficient staff or physical space to accommodate students.

Discontinuing clinical teaching at a site represents a significant loss of teaching expertise and infrastructure as any cessation of teaching necessitates significant later re-investment should the teaching responsibilities be resumed at a later time. Clinical sites may choose to terminate their teaching responsibilities out of a belief that cost savings will result. However, as is evident in the ‘Costs and Benefits’ section, the laboratory that ends its clinical teaching commitments also no longer realizes the intangible benefits of student presence and may experience significant costs due to the extra measures necessary to recruit and hire new staff when students are not readily available.

Furthermore, simply decreasing the numbers of students trained at a site may be a false economy: this measure does not take into account certain economies of scale that can be achieved when students are trained in cohorts. While, admittedly, the presence of students in large numbers can be disruptive (the definition of ‘large numbers’ varying with the resources available at a given site), there are certain educational activities that can be carried out more efficiently with a critical mass of students.

However, it shouldn’t be assumed from these comments that *all* clinical sites are relinquishing responsibilities for clinical education. The laboratory directors at three sites visited during this study expressed the desire for *more* students, acknowledging the highly advantageous access that clinical education gives them to potential employees: one site is often under-supplied with students because it is distant from the educational program and thus ranks lowest when students ballot for clinical placement assignments.

- *Over the next 10 years, 53% of our technologists will be eligible for retirement… We would take all the students we can get in order to meet our own needs.* (laboratory director)

4. Paying clinical sites to take students

As indicated in the findings from Phase 1 of this study (Appendix C, Tables 5A and 5B), some educational institutions reimburse their clinical sites for their clinical education responsibilities. Fees are constructed on the basis of a fixed amount per student per week, or derived from a funding formula with some allowances for increasing costs over time. Amounts ranging from $160 to $450 dollars per week per student were mentioned where formal agreements are in place.

These compensation mechanisms are funded mainly through the operating budgets of the educational institutions, which, appear to arise from provincial ministries or departments of education. However, the province of Québec has created a specific agreement between the ministries of health and education that recognizes the costs of clinical education and institutionalizes the transfer of funds on a per-student basis to compensate laboratories for clinical education.[55] For the 2003-4 school year, these funds were allocated at a rate of $12,018 for a 164-day period. [56] Such specific accountability mechanisms for the costs of clinical placements appear to resolve the issue of responsibility for the costs of clinical education. However, Québec hospitals still suffer from difficulties training students due to high technologist workload and insufficient space, so it would appear that explicit compensation mechanisms alone are not sufficient to resolve clinical placement problems. Payments must be appropriately directed to support the laboratories themselves and sufficient to enable the laboratory to address staff and space restrictions that constrain clinical education.

5. Offering non-monetary acknowledgements of teaching responsibilities

Acknowledgements offered to teaching technologists and clinical instructors vary from none at all to the provision of teaching workshops or continuing education courses by educational institutions, to luncheons and letters of appreciation by employers. (Only the province of Québec has acknowledged clinical education responsibilities with a salary premium and a distinct job category in its collective agreement, although one Ontario educational program reimburses its clinical instructors for personal time spent marking tests and conducting other forms of evaluation.) While the majority of teaching technologists and clinical instructors stress that they are involved in teaching for the intrinsic rewards it offers, they occasionally express some disappointment at the lack of acknowledgement they receive. The lack of formal extrinsic reward mechanisms (whether monetary or non-monetary) for this important

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[55] Gouvernement du Québec. (1982, 1989). Politique de collaboration entre le Ministère de la santé et des services Sociaux, le Ministère de l'enseignment supérieur et de la science et le Ministère de l'éducation dans l'organisation des stages. Contrat d'affiliation. Québec: MSSS, MESS et MEQ.

[56] Ministère de la Santé et des Services Sociaux. (2003). Circulaire #2003-017. Stage en établissement: Entente avec le ministère de l'Éducation. Québec: MSSS.

function is striking considering its potential as a recruitment mechanism for increasing support for clinical education in clinical sites.

6. Centralizing responsibilities for clinical education in the educational institution

Whether as a result of traditional protocols or recent changes, a number of educational programs maintain control over a major portion of clinical education responsibilities: these include setting tests and examinations for students in their clinical rotations, conducting on-site tutorials and orientations, introducing procedures and technology, providing all educational materials, and maintaining the records for scheduling and evaluation. In some cases, the relationship is formalized in the position of a clinical coordinator who is paid by the educational institution and who spends a fixed number of days at the clinical site with students, either individually or as a group.

Clinical instructors expressed appreciation for the continuity, consistency, and guidance that this format offered them. (Where such centralized arrangements were not in use, clinical instructors expressed the desire to have them put into place.) They also noted the advantages that centralization offers the didactic instructors in terms of fostering their familiarity with the resources and constraints of the clinical site. The enhanced relevancy of didactic instructors that would be afforded by a regular presence at the clinical site was also cited by students as a much-needed change to the didactic-clinical divide that now pervades a number of the programs.

However, some teaching technologists enjoy the rapport with students that evaluation and teaching responsibilities offer them; they are reluctant to surrender these tasks to the educational institution. They may also feel that they are in a better position to evaluate and tutor students because of their day-to-day contact.

In addition, while it may ease the burden of work and responsibility for those at the clinical site, shifting the described tasks to the educational institution does increase the time and effort involved for the staff there (and hence simply re-assigns these costs of clinical education from one site to another). It is a cost-shifting rather than cost-saving measure.

7. Using simulated laboratory experiences

For the purposes of this study, a ‘simulated experience’ is defined as a sustained environment (i.e., at least one or two weeks in duration) in which students conduct laboratory procedures designed to confer a learning experience without a concomitant contribution to laboratory productivity. As they occur in medical laboratory education, these experiences usually take place in the educational institution. This definition does not include practice ‘mock procedures’ set up for students in the clinical laboratory using real patient specimens. According to the data provided by participants in Phase 1 of this study, simulated experiences are in use to a significant degree in at least three Canadian medical laboratory programs. An Alberta study has proposed setting up a simulated clinical laboratory environment as a means of expanding the province's capacity to provide more medical laboratory technologists for the workplace while lowering the 'field costs' for clinical education; the funds requested to support this project were slightly under $600,000 and the savings to the associated health regions were estimated at $700,000.[57] The project has not yet been approved for implementation. This and other simulation projects have been investigated and/or put into place to address the challenges due to insufficient opportunities for students to gain experience in clinical sites, and are of great interest to educators for their potential to serve as alternatives to student placement in clinical sites.

This study did not specifically examine the appropriateness of simulated laboratory education. However, a number of issues became apparent in discussions with individuals who have had experience with it. Clinical instructors felt that, while simulations can introduce students to mechanical skills, such learning experiences have limitations for helping students to contextualize these skills amidst real workplace demands. Simulations based in educational institutions may not have sufficiently up-to-date equipment – because laboratory equipment quickly becomes obsolete – or may not offer relevant skills to adequately prepare students for their time in the clinical laboratory. Clinical instructors also commented on the difficulties of evaluating students' readiness for the workplace on the basis of simulated experiences. Simulated environments do not permit students to gain a sense of self-as-MLT, which is helpful for professional socialization; as well, they do not offer students a chance to appreciate the areas of the laboratory for which they are most suited for eventual employment.

- *There is no point in doing simulations on old equipment.* (laboratory director)

- *You just don't get the urgency in a simulation. How do you know how [students] are going to react?* (clinical instructor)

- *One of the students was on a chemistry bench … we had two or three people on vacation, and somebody phoned in sick that morning. [The student] was in at 7 … so she went to a bench tech, who said "Could you put this on … put on the controls … plot the values … and put them in the computer?" So that's what happens in a real lab. It's not going to happen in a simulation.* (clinical co-ordinator)

Students reported being aware of the simulated nature of such laboratory activities and adjusted their engagement in and valuing of the experience. According to students, the most memorable learning opportunities in clinical education arise as a result of:

- working side by side with MLTs who model profession-specific behaviour and problem solving;
- feeling like a member of a team in a collegial health care environment;
- gaining a sense of contributing to patient well-being;

[57] Raasok, M., Hughes, E., Tron, V. (2004). Medical laboratory sciences clinical simulation project - 2003/04. Edmonton.

- appreciating the rhythm and challenges of laboratory workflow and the strategies for addressing them;
- experiencing non-routine aspects of laboratory procedure and patient specimens;
- working with up-to-date techniques and instrumentation.

With the exception of the final point, these opportunities are not available through simulated experiences, and the final item is available only where the simulated environment has sufficient initial and ongoing investment to accurately reflect the technologies and responsibilities of the workplace. This points to the high start-up and maintenance costs for an effective simulated laboratory experience, not to mention the heavy commitment of skilled personnel to run them.

Respondents' comments suggest that the key to the success of simulated laboratory experiences is their authenticity. Some elements of real laboratory work cannot be reproduced in a simulated environment. Other elements increase the cost of the simulation to the point where it may rival the cost of the clinical environment. The creation of simulated experiences appears to simply transfer the costs of educating MLTs from the clinical site to the educational institution rather than offering any absolute cost saving. In fact, some simulated environments may duplicate resources already available at clinical sites. Not only do simulated experiences involve a considerable financial cost for the educational program but they do not accrue benefits to the same degree that the presence of students in the workplace do (see the 'Costs and Benefits' discussion for further information). And to be fully effective, the simulated learning experience may need to be followed up with time spent in the real environment. Creating an effective simulated environment for medical laboratory education may actually be more costly than providing the appropriate support for education in the clinical environment, where the expertise, resources, and authentic learning experiences are already in place.

If the move toward simulated laboratory experiences were driven by pedagogical validity that had been established through empirical studies, the use of simulated laboratories would be more solidly founded than the current situation, where the change is driven by cost constraints unaccompanied by the necessary evidence base.

8. <u>Finding out-of-province or out-of-country sites</u>

One medical laboratory program is sending small numbers of its students to two (soon to be three) clinical sites in a neighbouring province because the regionalization and laboratory cutbacks in its own province have drastically reduced the available sites for placements. In other professions, international placements are in use or in development.

Placements in sites remote to the educational institution present hardships for students, both in terms of the financial investments required (travel and accommodation) and the dislocation from home and family. Furthermore, students at distant sites do not have access to the resources of their educational institution despite the fact that they are paying tuition that includes fees for the athletic, health, and reference resources of the educational site.

Placing students at remote sites also incurs costs for the educational institution: for initial site visits and consultations to ensure the appropriateness of the sites; for ongoing communication between educational staff, the clinical site staff, and the student; and for provision of any necessary educational resources that students may need while away from home.

When one province places students in another province, this depletes the capacity for programs in the second province to expand its medical laboratory programs.

Finally, placing students at remote sites runs the risk that students will be recruited to work there after graduation rather than returning to their home province; remote sites are no less interested in these professionals and may offer incentives for students to stay once they graduate. Students will thus have had their education subsidized by one province while subsequently contributing to the workforce in another.

9. <u>Sending students out as part of health professional teams</u>

Medical laboratory students travel to rural or remote sites as part of a team with other health professional students. This may ease the difficulties of student relocation and isolation, offers students an opportunity to appreciate professional practice in rural communities, and supports the development of teamwork skills. This type of program is typified by BC's Interprofessional Rural Program (IRPbc).[58]

10. <u>Assigning individual students to more than one location</u>

The reorganization of laboratory services with assignment of certain procedures to regional centres has meant that many clinical sites do not perform the full test menu necessary to introduce medical laboratory students to all the required competencies. A number of programs have found it necessary to send each of their students to two or three sites over the course of their clinical placement in order to ensure that they have an opportunity to develop the full range of competencies required. It is possible that some potential sites for clinical education remain untapped as a result of concerns about sending students to multiple sites, perhaps because of the difficulties students may have in arranging transportation. In addition, such arrangements increase the complexity of organizing the clinical placement rotations.

11. <u>Student bursaries and other forms of support</u>

The practice of funding medical laboratory students has been used intermittently in Canada, most often as a recruitment mechanism when MLTs are in short supply. Several Canadian provinces are offering limited numbers of health professional students financial support in amounts from $2,000 to $8,000 for the clinical portion of their studies (these bursaries are tied

[58] BC Academic Health Council. (2004). Welcome to IRPbc. [Online]. Accessed September 24 2004. http://www.bcahc.ca/irpbc/

to a commitment for work, as described in point 12, below). This scheme may be particularly worthwhile to enhance the attractiveness of rural placements.

In addition, the provision of other resources might increase the appeal of a remote placement: accommodations, computers, online resources, and library or athletic privileges are examples of such inducements.

12. <u>Making placements conditional on student commitment to work at a given location</u>

Although this strategy is not commonly in use for medical laboratory students, it has been suggested or implemented in other health professions as a means of ensuring that rural or remote sites can count on staff for a given period of time.

13. <u>Finding *ad hoc* clinical sites for limited periods</u>

One educational program was able to arrange a placement for a cohort of its students for one year only. While this solution met a short-term need, the program returns to its prior difficulties with clinical sites once this one-time contract is terminated as the clinical site is not willing to continue the arrangement without further financial support.

14. <u>Use of multiple placement models by the same educational institution</u>

One educational program operates with different agreements for two of its clinical sites: with the first, the educational institution leaves many of the organizations and evaluation functions to the individuals at the site, while it conducts all these functions (as described in the centralized model outlined in point 6, above) for the other clinical partner. In the former case, the model suits the preferences and traditions of the clinical site, while the centralized model was offered to the second clinical site to increase the attractiveness of the initial recruitment proposal to the site for clinical education. Maintaining two clinical placement models involves a high level of educator time and effort and has the potential of creating widely differing learning experiences for the students.

15. <u>Creating new partnerships</u>

One clinical site repeatedly experiences difficulties retaining the students it trains because it is not in the same city as the educational institution. Most of its students live near the educational institution and prefer to return to their home town. For this reason, the clinical institution has approached a local university to propose the establishment of a new medical laboratory program in the clinical site's city. Future students from the distant educational institution are not anticipated to be available in sufficient numbers to meet the staffing needs of the clinical site so the clinical institution is attempting to meet its own needs through the establishment of a new medical laboratory program.

We want to provide an opportunity for the local folks. The students who come here from [the educational institution's city] want to go back there when they're finished. (laboratory director from a site seeking to establish a local medical laboratory program)

16. <u>Non-traditional scheduling</u>

Clinical placements have traditionally (but not exclusively) taken place during business hours, which coincide with the timing of heaviest periods of laboratory workload. Assigning students to evening/weekend/night shifts has been tried on a limited basis to decrease the demands that teaching activities place on day staff and can reduce the crowding during peak staffing hours. It also has as an advantage the opportunity it gives students to appreciate the 24/7 nature of laboratory practice rather than the artificial day-shift-only impressions of the work that they may gain from traditional 5 day-a-week scheduling of placements.

However, this strategy requires the availability of staff on these other shifts who are experienced in teaching and willing to take on students. It may also introduce additional challenges to the already complex task of scheduling student rotations.

17. <u>Sharing of sites by multiple programs</u>

Several clinical sites host students from more than one educational institution. In the case of at least one such site, the clinical staff faces the challenge of accommodating widely differing clinical placement practices, including different evaluation mechanisms, differing protocols and documentation of competency-based practices, and dissimilar support mechanisms for clinical instructors. While the clinical site is to be admired for its willingness to carry out clinical education under these circumstances, this situation appears to create challenges that, given the heavy workload experienced in this laboratory, would make the presence of multiple programs at the site unsustainable over the long term. The differences among programs in terms of implementation of clinical placements are acutely felt when one site attempts to accommodate students from more than one program. As well, sharing sites places limits on the extent to which the individual programs can expand their student class sizes without affecting the clinical site and the partnered educational institution.

This sharing of sites is in addition to the multiple medical laboratory programs (medical laboratory, cytotechnology and clinical genetics) that any one site may accommodate as well. In addition, several sites are hosting students from bridging programs for internationally-trained technologists who require clinical experience in order to gain Canadian certification. The integration of international technologists into the profession through bridging programs is a strategy designed to enhance the medical laboratory workforce and to take advantage of the expertise of these individuals. However, these students draw on the same resources in the clinical sites that full-time medical laboratory students require and thus decrease the number of sites that can accommodate full-time students. Without specific attention to expanding the capacity of clinical sites for students, training of international students in bridging programs simply decreases the number of graduates from full-time medical laboratory programs, nullifying the net increase in the medical laboratory workforce.

18. <u>Use of private sector facilities</u>

With the exception of one laboratory in one province, the private sector is notably absent from participation in clinical education of medical laboratory technologists. Given that private laboratories benefit from the competent medical laboratory workforce, their participation in the preparation of that workforce might not be an unreasonable expectation. The one private firm that provides clinical places has identified educating the laboratory workforce as a deliberate corporate goal. However, its presence as one of the sole providers of laboratory services in its home province means that it has taken on (and is expected to take on) a disproportionate responsibility for clinical education of medical laboratory students. Private firms face similar challenges to public institutions in providing clinical education and are no more in a position to provide financially unsupported clinical education to large numbers of health professional students than are public facilities.

19. <u>On-site student laboratories</u>

The on-site student laboratory consists of a room close to the main laboratory in which students can occasionally carry out assigned laboratory tasks (which are part of the authentic laboratory workload) in the presence of the teaching technologist but apart from the busy main laboratory. Such a facility addresses the space and time challenges of combining high workload levels with educating students. This arrangement can benefit both the student and the main lab, but leaves staff to handle the workload without the teaching technologist and requires sufficient staff and physical space to enable the use of a room dedicated to students. Few laboratories have such facilities and many were required to convert spaces previously set aside for students to laboratory use when sites were downsized and reorganized. Crowding is a common complaint among laboratory personnel; few laboratories have the luxury of assigning space for student activities although several sites reported that they are including space for student activities in plans for future renovations of their laboratory facilities.

20. <u>Staggered clinical placements</u>

A common model for medical laboratory education involves the clinical education period at the end of the educational program. However, several programs offer staggered placements in which students alternate clinical rotations with instruction (or a simulated experience) at the educational institution. Some students find a well-timed early placement extremely valuable in orienting them to the demands of laboratory work and in motivating them to continue their studies. Staggered placements may also help to minimize the demands placed on clinical sites by permitting students to rotate in and out of the site.

- *Students have a clear idea of what they're getting into as a result of the early time spent in the lab. They can also get a job in a lab after that experience.* (laboratory director)

One laboratory director also considered clinical placements early in the program an 'effective filtering mechanism' for identifying students who are not suitable for laboratory work and who might otherwise not discover this mismatch until much later when they had invested considerable time, effort, and money into their education for the medical laboratory. Students report a valuable level of comfort with laboratory theory and practice after an early placement in the laboratory, although they find the initial sense of responsibility 'nerve-wracking'.

The one set of negative comments about staggered placements came from students who were required to return to the educational institution for a semester after their clinical placement as part of the academic requirements of their educational institution. Although students appreciated the opportunity that this semester provided them to prepare for CSMLS examinations, they felt that it was a letdown; it interrupted their momentum and took them away from what they really wanted to be doing. The laboratory director and instructors at the clinical site saw a disadvantage in this practice, too, in that students who left might not accept offers of work if they had been away from the site for the semester.

21. Creation of networks for resource sharing

The Health Sciences Placement Network (HSPNet) of British Columbia is "an interactive, web-enabled system for coordinating and streamlining clinical placements for health sciences students in British Columbia."[59] It is the first of its kind in Canada and appears to be experiencing some success in enabling a collaborative and efficient approach to placing students from multiple professions in suitable sites.

22. Reorganizing clinical rotations to reflect the reality of the workplace

Most general medical laboratory programs appear to have retained traditional models for organizing their students' clinical rotations on the basis of the five sub-disciplines. However, workplaces have undergone a number of reconceptualizations of laboratory work that arise both from technological innovations and the need for efficiency and new work processes. These shifts include the use of stat or core labs and the 'chematology' laboratory, among other changes. In some instances, student rotations have been adapted to blend the clinical practicum more seamlessly with the workplace. It is possible that such adaptations may eventually need to extend to re-consideration of the medical laboratory competency profile and educational program curricula.

[59] BC Academic Health Council. (2004) Health Sciences Placement Network of BC. Online. Accessed September 29 2004. http://www.hspbc.net/

23. Appeals for funding for clinical education

Despite frequent claims by health professional educational programs that increased funding for clinical education is needed, the appeals have not met with a great deal of success.

However, should such funding materialize, it will be necessary for health professionals to accept the fact that increased funding is invariably accompanied by increased accountability procedures and the need to standardize processes. The funds must go to support the work of those carrying out the clinical education rather than disappearing into some institutional global pool. Educators bear some responsibility to examine current practices, to be open to data-gathering, research and validation and to accept the need for change in return for external support for clinical education.

SUMMARY

The lack of sufficient places for medical laboratory students at clinical sites was cited repeatedly by medical laboratory program directors as the main obstacle to meeting workplace needs for competent MLTs. It is evident from this discussion that the situation is a great deal more complex than simple numbers can convey. The challenges resulting from the lack of clinical placements have both encouraged innovation and necessitated that medical laboratory programs undertake coping strategies that may not necessarily be founded in empirical research on their pedagogical validity. The strategies and alternatives described here represent the efforts undertaken to demonstrate flexibility and responsiveness to local conditions. This summation is the first attempt to present them all in one document and may facilitate information-sharing of successful practices among educators. There is some promise in strategies such as staggered clinical placements, non-traditional scheduling, and centralizing responsibilities for clinical education in the educational institution. While none of these strategies will resolve the challenges faced clinical placement of medical laboratory students in the absence of action on the key recommendations presented later in this report, they may assist in alleviating some of the more stressful aspects associated with combining teaching and laboratory work in the clinical setting.

COSTS AND BENEFITS

Not the only focus of this research project, the presentation of findings on the costs and benefits of clinical education of medical laboratory technologists is nonetheless a subject of great interest to the participants in this study. Few participants had collected data on this topic, although two offered documentation that evidenced efforts to take financial costs into consideration where educational institutions were compensating their clinical sites.

The discussion of costs and benefits is divided into three sections: (1) the costs and benefits table developed in this study, which outlines all the elements validated by study participants; (2) a discussion of the elements of the table to clarify their roles and the variations observed; and (3) the algorithm constructed from the table, which permits calculation of costs and benefits at an individual site.

THE COSTS AND BENEFITS TABLE

Study participants in both phases, whether contacted through written survey or by personal interview, were asked to review the table of costs and benefits developed through the extensive review of the literature conducted at the beginning of this project (Table 1). The validation process was iterative in that modifications suggested by program directors in Phase 1 were incorporated into the table and used for the version distributed to participants in Phase 2. When participants in Phase 2 suggested additions to the lists, their suggestions were proposed to later interviewees and validated for inclusion. In addition, the table was presented to various stakeholders not directly part of this study (for example, the Canadian Association of Medical Laboratory Educators) for their consideration. Table 2 presents the final list resulting from this entire consultation process. The extent to which this table has evolved from that originally developed for this study is quite evident. Each of the elements of the table is discussed in further detail later in this section.

It should be noted that several of the elements in the table do not apply to all individuals and sites consulted. For example, most health facilities do not pay salary premiums or overtime to their teaching technologists, nor do all teaching technologists report benefiting from an enjoyment of teaching. However, the goal of this exercise in the study was to assemble as exhaustive as possible a list of costs and benefits to facilitate further discussions, and in this the table appears to have the support of study participants.

	TANGIBLE	INTANGIBLE
COSTS	**CLINICAL SITE** • staff time • educational materials • space and facilities • student-performed procedures • liability/malpractice insurance • paid overtime **EDUCATIONAL INSTITUTION** • educational materials • staff time: scheduling, meetings • travel costs to clinical sites • accreditation, liability/malpractice insurance **STUDENTS** • relocation costs: travel, living expenses • tuition fees • immunization and other pre-requisite costs	**CLINICAL SITE** • decreased staff efficiency **CLINICAL INSTRUCTORS** • stress and frustration due to additional work and intensified workload • burden of responsibility • unpaid overtime **STUDENTS** • stress • uneven quality of instruction
BENEFITS	**CLINICAL SITE** • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel • fees paid by educational institution **CLINICAL INSTRUCTORS** • paid overtime • complimentary courses and workshops • salary premiums **EDUCATIONAL INSTITUTION** • tuition fees	**CLINICAL SITE** • improved staff performance • prestige • enhanced overall staff expertise and currency • fulfilling a social responsibility • contribution to competent workforce • student contributions to workload • enhanced academic focus to teaching institution • facilitation of staff scheduling **CLINICAL INSTRUCTORS** • increased job satisfaction, morale, self-esteem • acquisition of transferable skills • upgrading/professional development credits • prestige of job description • acknowledgement mechanisms (luncheons, certificates) • enjoyment of teaching and sharing skills/knowledge • contribution to workplace and profession • expression of professionalism **STUDENTS** • enhanced marketability • facilitation of job search & introduction to job market • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of 'grey areas' of work • gaining Canadian experience where needed • enhanced confidence • opportunity to select a disciplinary specialty • opportunity to work on special techniques and projects • opportunity to contribute to delivery of health care **EDUCATIONAL PROGRAMS** • recruiting appeal to potential students of hands-on experience as part of program • enhanced student assessment opportunities **HEALTH CARE SYSTEM** • a competent workforce • enhanced quality of care

Table 2: The costs and benefits of clinical education identified in the clinical education literature and subsequently modified and validated by major stakeholders in the education of Canadian medical laboratory technologists

This table offers a more comprehensive listing of costs and benefits than has been found in any of the relevant literature and documentation consulted for this study. It is useful for a number of reasons. First, it permits a visual appreciation of the complex interrelationship of costs and benefits of clinical placements, including the fact that benefits (and particularly intangible benefits) are considerable. The table illustrates frequently overlooked aspects of the costs and benefits of clinical education, including that entities other than the clinical sites incur costs in the process and that there are numerous benefits to clinical education as well. In fact, a number of interview participants stated emphatically that they believed the benefits of clinical education outweigh the costs.

Second, the costs and benefits table presents the elements necessary for elaboration of a cost-benefits guideline, as will be modeled in the construction of the algorithm that follows. Finally, as pointed out by several participants in this study, the costs and benefits table has the potential to serve as a persuasive tool for medical laboratory educators who would like to garner additional support for clinical education from laboratory sites.

GENERATION OF THE ALGORITHM

This discussion provides the details on the elements of the Costs and Benefits Table created through this study (Table 2). As the discussion progresses, the various elements are placed within a frame to construct the algorithm (Figure 1). The wide variations in the actual implementation of clinical education programs precludes any exact statement of figures for these elements. However, the final algorithm will enable individual programs and health care facilities to ‘plug in’ their own figures and arrive at a figure for their costs and benefits. This necessitates that sites and educational institutions be aware of their costs, which is an advisable step that is not necessarily observed by most institutions. At all times, the benefits and all intangible elements are assumed to have a presence in the process.

The figure ultimately derived from application of the algorithm will be the cost per student per week of the placement. Reducing the cost to a weekly number facilitates comparison among programs with differing clinical placement lengths. Another important consideration is that the costs of setting up a clinical education program and of running it for the first couple of years will be higher than the costs to maintain it in the long run. It is important, therefore, to re-evaluate the clinical education program at regular intervals, both to capture this declining cost and to get a sense of the one-time-only or occasional costs that may not necessarily appear in annual planning for clinical education.

The discussion begins with tangible costs and benefits and then moves to consideration of intangible elements. All ‘costs’ refer to documented expenses made within one clinical education period, regardless of its length. The final figures are adjusted to a per student/per week figure.

FIGURE 1: An algorithm for appreciating the costs and benefits of clinical placements

CLINICAL SITE COSTS

STAFF TIME

HOURS Lab Manager	x (hourly wage + benefits)
HOURS n Coordinators	x (hourly wage + benefits)
HOURS n Instructors	x (hourly wage + benefits) x .75 (first 10 weeks)
HOURS n Instructors	x (hourly wage + benefits) x .50 (second 10 weeks)
HOURS n Instructors	x (hourly wage + benefits) x .25 (remaining weeks)
HOURS n Human Resources	x (hourly wage + benefits)
HOURS n Health Services	x (hourly wage + benefits)
HOURS n Support staff	x (hourly wage + benefits)

LEARNING MATERIALS

Photocopied Materials (tests, procedures): # of pages x cost per page
Orientation materials (pamphlets, brochures): # of units x cost per unit
Texts, reference books, study guides: itemized on a per unit basis
Educational equipment (i.e., teaching microscopes)
Reagents

SPACE AND FACILITIES

Square feet of student space x cost/sq. ft./year x % use by students

MISCELLANEOUS MATERIALS AND RESOURCES

Protective equipment (lab coats, gloves, goggles)
Institutional services (laundry, lockers, parking passes)
Training sessions
Liability insurance
Health services materials

PAID OVERTIME

Overtime costs per clinical placement year attributable to student presence

EDUCATIONAL INSTITUTION COSTS

STAFF TIME

HOURS Program Director	x (hourly wage + benefits)
HOURS n Clinical Coordinators	x (hourly wage + benefits)
HOURS n Faculty members	x (hourly wage + benefits)
HOURS n Human Resources	x (hourly wage + benefits)
HOURS n Health Services	x (hourly wage + benefits)
HOURS n Support staff	x (hourly wage + benefits)

MISCELLANEOUS MONIES PAID TO CLINICAL INSTRUCTORS

LEARNING MATERIALS

Photocopied Materials (tests, procedures): # of pages x cost per page
Orientation materials (pamphlets, brochures): # of units x cost per unit
Texts, reference books, study guides: itemized on a per unit basis
Reagents and expendables
Educational equipment (i.e., teaching microscopes)

TRAVEL COSTS

Airfare, gas & mileage, accommodation, meals, parking

MISCELLANEOUS EXPENSES

Accreditation fees
Liability/malpractice insurance
Graduation ceremonies & materials

STUDENT COSTS – MISCELLANEOUS COSTS

Transportation, food, accommodations
Tuition fees
Costs pre-requisite to placement

(INTANGIBLE COSTS)

CLINICAL SITE BENEFITS

Recruiting, hiring, orienting new staff
Fees paid by educational institution

EDUCATIONAL INSTITUTION BENEFITS

Tuition fees

CLINICAL INSTRUCTOR BENEFITS

Paid overtime
Complimentary courses/workshops
Salary premiums

(INTANGIBLE BENEFITS)

$$\frac{\textbf{SUM OF COSTS} \;-\; \textbf{SUM OF BENEFITS}}{\textbf{\# of STUDENTS} \times \textbf{\# of WEEKS OF PLACEMENT}}$$

= COST PER STUDENT PER WEEK

COSTS – TANGIBLE

<u>Clinical site – Staff time</u>

All participants agreed that staff time is the major cost in the provision of clinical education; estimates placed it at 80 – 90% of the total costs. The 'staff' included in this element include laboratory directors, clinical instructors, bench technologists, human resources personnel, and laboratory/institutional support staff. The costs of staff time at the clinical site are dependent on: (1) how long the site has been training students (which influences the preparation time needed and possibly the efficiency of the instructional processes) and the resulting availability of pre-existing materials/templates/guidelines; (2) the department under consideration (some departments need to exert a greater intensity and duration of student supervision because of the nature of the procedures they are performing; (3) the length of the stage in student's rotation (the amount of attention needed by students declines rapidly with time); (4) the number of students: certain efficiencies can be gained where two or more students move in parallel, but too large a cohort of students can be more disruptive than productive because of the resources and space required; (5) the individual teaching style of instructor/technologist (some instructors may feel more comfortable maintaining a high level of vigilance over students at all times – they thus make heavy use of their own time and may not permit the student to ease the workload; and (6) the types of duties expected of teaching technologists (i.e., marking tests, at the bench instruction, discussions, seminars, scheduling).

Because there is potentially a large number of individuals involved in this portion of the calculation, it is important to assess the contributions of all individuals who have student contact or responsibilities for student presence at the clinical site. Furthermore, study participants contributed some critical observations that must be considered in these calculations. First, they pointed out that the time required to plan and implement a new clinical education program in its first years is considerably greater than the time required to maintain the program in subsequent years. This means that figures for total costs arrived at on the basis of observations made at the start of the program must be re-evaluated two, three or four years into the program because they will over-estimate the ongoing costs once the program is in place.

Second, it is important to remember that estimates of time spent with students may actually over-estimate the costs of staff time. Again, study participants were helpful in pointing out that instructor time is not sustained at a consistent intensity: students make considerably greater demands on instructors' time and attention at the beginning of their time together than they do as the student gains familiarity with the procedures. What this means is that simply assuming that instructors spend 7.5 hours a day with a student over-states the costs of the instructional process and under-estimates the contribution that the teaching technologist continues to make to the laboratory workload. Students draw on the time and energy of their instructors most substantially at the beginning of their interaction with the instructor on a particular learning activity. As their familiarity with the activity increases, the demands they place on the instructor (and hence the cost of the instructional time) decline. Given enough time (i.e., a sufficiently sustained opportunity to work on that activity) a student's requirements for actual instruction may be negligible although they will always require a certain level of supervision of their activities. This is a significant consideration for very short clinical placement periods: the relatively short instructional periods mean that students are making maximal demands on their instructors for much of their time spent in the laboratory, and hence are operating at the highest level of cost for staff time.

For the purposes of this calculation the number of hours equals the total amount of time in hours that a given individual spends over the entire clinical placement period on matters directly related to clinical placement of students, and ‘n’ recognizes that multiple individuals in that category may be associated with clinical education activities. Where individuals at differing salary scales are involved, the figures should be broken down to represent their individual contributions to the costs.

What counts as ‘time’?
Most laboratory directors and clinical co-ordinators had few difficulties being specific about the amount of time they spend on clinical education. For example, one clinical co-ordinator at a clinical site that had been involved with student training for a number of years readily noted that she spends approximately 5.5 days (with eight students over a 37 week placement period) on her co-ordinating duties. St. Clair College has estimated co-ordinating time at 1.5 hours per student per week.[60] Administrative and support staff may have similarly clear ideas of their student contact hours. Where teaching technologists are given ‘release time’ from their bench duties or are seconded from other positions for a period of time, it will be similarly straightforward to appreciate the time allotted for student contact. These activities involve ‘dedicated time’ in which planning and student contact hours are readily identified.

However, as indicated elsewhere in this report, at-the-bench teaching is a complex blend of ongoing laboratory tasks and simultaneous instructional responsibilities, referred to earlier as a ‘buffering’ process in which many bench technologists absorb teaching responsibilities into their existing workloads. They begin their instructional time with fairly intense demonstration and commentary, and gradually permit students to assume a hands-on role. As one clinical instructor described it, students first ‘shadow’ their instructor, then they ‘mirror’, and then they act independently. This suggests that students demonstrate a decreasing dependency that parallels decreasing requirements for instructor time and attention (and hence, decreasing costs for staff involvement in this aspect of student presence). Students make their greatest demands at the start of a rotation. It is possible to speculate that the first ten weeks of a student’s clinical placement is spent at 75% demand level (i.e., that it would require a 0.75FTE to carry out responsibilities theoretically ‘displaced’ by teaching tasks). The next 10 weeks may occur at a 50% demand level, and the remaining time at 25% demand level. These numbers are drawn from the comments of interview participants and from observations made at laboratory sites and are consistent with observations made about the growing contributions made by students over time. These figures would benefit from validation/adjustment through focused empirical study.

(It should be noted here that clinical instructors in Québec are paid a teaching premium, $6.22 per hour, for their responsibilities; this appears in their collective agreement as part of the job description for their teaching positions. Inclusion of this specific a remuneration mechanism

[60] St. Clair College of Arts and Technology. (2000). Medical laboratory technology program. Billing for clinical year. Instructions for calculating costs. Windsor ON: St. Clair CAAT.

facilitates tracking costs for clinical education in addition to acknowledging the status of clinical education in institutionalized union documentation.)

What this suggests is that estimates of the costs of staff time require a 'stepping down' rather than a uniform implementation across the entire placement period. They also are consistent with the comments made elsewhere in this report about the high degree of intensity reported for short clinical placement periods. This stepping down process is reflected in the algorithm.

Clinical Site - Learning materials

Participants at some sites felt that these costs were minor – photocopied materials every now and then. This is perhaps representative of those clinical sites where the educational institution provides a large portion of the educational materials. However, at other sites, clinical instructors prepare evaluation materials and students are provided with pamphlets or orientation materials. Clinical sites may also purchase texts, reference books or prepared study guides. Included here, too, are one-time purchases of teaching items (for example, teaching microscopes) that augment the teaching program. If their use is not dedicated solely to clinical education of medical laboratory students, the costs must be allocated in proportion to their use.

Study participants felt that reagents used for student-performed materials were an extremely minor element. In many cases, the students are learning using materials that would be used for laboratory procedures regardless of the presence of students. Participants acknowledged, though, that this varies from one department to another, particularly in cases where students must carry out 'mock' procedures before being allowed to work on patient specimens. Participants felt that such expenses represented, at most, 10% of the total costs for a clinical placement. In additional to the variation among departments, institutional traditions also make this element of the cost fairly difficult to predict.

As examples of these costs, St. Clair College estimates supplies for student learning at $250 per student per 37-week placement, while Dawson College pegs this cost at $13 per student per week for 28 weeks.

Clinical site – Space and facilities

Most of the sites reported no dedicated space for student use so for most institutions, space and facilities costs are actually intangible in that they consist mainly of the stress and disruptive effects of overcrowding. However, in the rare instance where dedicated student facilities are available, the overhead costs of maintaining this space must be considered. If the space is also used for other purposes, as is usually the case, this must enter into the calculation as well (expressed as the percentage use of the space by students). It is assumed that clinical sites will have access to institutional overhead costs on a per square foot basis.

Clinical site – Miscellaneous expenses

Not all expenses suggested for this category apply to all sites. Additional materials mentioned by participants included provision of lab coats, gloves, safety goggles and other personal protective materials; institutional services (for example, laundry, lockers or parking passes); training sessions (i.e., CPR or hazardous materials seminars); liability insurance for students (where it is not covered by the educational institutions); and materials used in the delivery of any health services (i.e., first aid materials, vaccines) provided to the students.

Also included in this category are one-time expenses such as equipment purchased exclusively for the use of students, such as microscopes, although these must be identified as outside of ongoing operating costs for the clinical education program.

Clinical sites - Paid overtime

According to study participants, paid overtime was the exception rather than the rule. This element acknowledges the cases where it does occur. Only paid overtime directly attributable to clinical teaching responsibilities (i.e., direct instructional time or time required to complete work deferred due to instructional responsibilities) should be included here.

Educational institution – Salaries

At the educational institution a number of individuals may be engaged for varying amounts of time in activities directly related to clinical education (such as planning, scheduling, preparation of educational materials, meetings, communicating with students or staff at the clinical site, provision of support services, record-keeping, workshops, site visits). As for the clinical site, these individuals must be itemized with respect to the hours they spend, keeping in mind that re-evaluation of time spent in setting up a program must be re-evaluated once the program is established. Salary costs for educational institutions also cover any payments made by the educational institution for services of clinical instructors. For example, budgets for $72 per week to be paid to instructors if their personal time is spent on teaching-related activities such as marking tests and other evaluation materials.

Educational institution – Educational materials

These expenses can be considerable where the educational institution has taken on the responsibilities of furnishing students and clinical instructors with manuals, workbooks, tests, and guidelines. Also included here may be workshops provided to clinical sites. For example, one educational institution offers its clinical instructors at no cost teaching workshops that are available to outside individuals and organizations for $300 – 350 per person (these costs include staff time and educational materials).

Educational institution – Travel costs

Travel costs vary widely depending on the number and location of sites affiliated with the educational institution. Support of out-of-province or remote sites will incur larger expenses than that supplied to local sites. Educational institutions would benefit from tracking such costs as they apply to individual sites so as to accumulate documentation on support costs for non-local sites.

Educational institutions – Miscellaneous costs

Educational institutions incur costs for accreditation fees levied by the accreditation organization (the Conjoint Accreditation Committee of the Canadian Medical Association), liability/malpractice insurance, and graduation ceremonies and materials.

Students – Miscellaneous costs
Students incur costs for their clinical placements, particularly if they must relocate to another city and/or travel back and forth between the clinical site and the educational institution for scheduled sessions. These costs include transportation, food, and accommodations. At the same time, students are paying tuition fees (which amount to a 'clinical placement fee'), despite the fact that, in the case of students who are placed far from their home, they are not able to use a number of the resources for which they are paying their fees (such as athletic facilities, library, computer labs, etc.) Students are also often required to pay for immunizations or workshops (First Aid or CPR) that may be pre-requisites to working in the clinical site. Some students find it necessary to take on part-time jobs (either as assistants in the laboratory or outside) in order to support themselves and/or their families through the clinical placement period.

BENEFITS – TANGIBLE

Clinical site
There is a strong economic incentive for health facilities to train health professionals. The recruitment opportunities provided when students train at a site is the benefit mentioned most frequently by laboratory directors when they were asked why they participate in clinical education of medical laboratory technologists. In answer to questions about the proportion of students they hire after graduation, laboratory directors give answers like, "As many as I can get". They acknowledge that students' presence in the laboratories and their interactions with other staff members permit them to assess students' suitability for working in that environment, to make offers of employment to students, and to avoid the need for advertising for, interviewing and orienting new employees. This recruiting advantage translates into significant cost benefits: U.S. studies published in the 1990s estimated the costs of replacing laboratory personnel at $16,000 to $20,000 per employee[61,62] and literature since that time has reaffirmed these economic benefits.[63,64,65,66] These figures do not include lost productivity costs incurred when a laboratory must function at less-than-optimal staffing levels due to unavailability of suitable employees.

- *Clinical education lets the different departments get a good idea of the group and to make a choice about the students that they would like to recruit … For the department that hires the students, training is half-done. All that's left are the details after hiring.* (program director)

- *Clinical placement is a sustained job interview.* (student)

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[61] Best, M. L. (1990). Lab administrators' role in retaining professionals. *Lab Observer,* August, 46-50.
[62] Snyder, J. R. (1992). Manpower needs in the year 2000: Medical technology education. *Laboratory Medicine, 23*, 416-9.
[63] Harmening, D. (1998). *Benefits of a clinical affiliation*. Baltimore MD: Department of medical and Research Technology, University of Maryland School of Medicine, DMRT and DH Publishing.
[64] Phelan, S. E., Daniels, M. G., & Hewitt, L. (1999). The costs and benefits of clinical education. *Laboratory Medicine*, *30*(11), 714-9.
[65] Jones, B. (2001). Examining the costs and benefits of clinical education. *NAACLS News, 79* (Fall), 5.
[66] Mass, D. (2002). The manpower shortage: What next? *Laboratory Medicine*, *33*(7). 505-10.

Clinical sites that are reimbursed by educational institutions for their clinical education activities also realize a financial gain from the process, although laboratory directors may not see these gains directly if the funds are not allocated to the laboratory budget.

Clinical instructors

Any paid overtime, salary premiums or complimentary course offerings are included in this category.

Educational institution

Tuition fees paid by students during their clinical education period can be considered a fee-for-placement. A comparative analysis of the tuition fees of the varying programs and the differing allocations of these fees could prove enlightening: for example, do students of university-based programs continue to pay relatively higher tuition fees for what is essentially a similar clinical placement experience as that offered to college students?

INTANGIBLE COSTS

Clinical site:

No studies have been performed to quantify the loss of laboratory staff efficiency that results from the presence of students but, as this report suggests, the loss of efficiency is directly proportional to the costs of clinical education over time: the loss of efficiency is greatest at the beginning of a new clinical education endeavor (as is the cost) and decreases as the staff members become more familiar with their responsibilities; similarly, the loss of efficiency is greatest at the beginning of a clinical rotation or new 'bench' and declines as the student's demands on the instructor lessen. The extent to which this loss of efficiency occurs and dissipates is dependent on the factors discussed earlier under costs for clinical sites.

Clinical instructors

Technologists involved in teaching students admit that they experience a fair degree of stress and frustration associated with their teaching responsibilities. Interestingly, these reactions are not so much directed at the students as at the workplace obstacles to their enjoying *both* their teaching and their laboratory duties; they feel a sense of obligation to perform both responsibilities at a high level of quality and feel regretful that they must sometimes set aside their teaching tasks in order to keep up with their heavy workloads.

A number of instructors admitted that they often worked overtime when their teaching responsibilities left them unable to complete their laboratory work within regular hours. However, most technologists said either that their institution did not encourage/permit claims for overtime work or that they (the technologists) simply wrote off the time as part of their contribution to their profession. They seem to do the latter happily when they can attribute it to a valuable learning experience for themselves and their students. However, it is important to note that the frequency with which unpaid overtime goes unacknowledged may contribute to the pervasive lack of appreciation among those outside the lab for the contributions that teaching technologists make to the clinical education process.

Students

Students report that their clinical rotations are somewhat stressful, much more so than their didactic experiences. Their work is fairly demanding; they often have assignments or projects to work on outside of regular hours; they are given frequent quizzes and tests to assess their progress. Students also report a keen awareness of and dissatisfaction with the differences in quality of learning experiences from one site to another; they consider this to be an unjust situation.

INTANGIBLE BENEFITS

Clinical site

A number of study participants felt that loss of productivity was not as serious an issue as others maintained, and even suggested that staff performance is enhanced by the presence of students in the laboratory. They maintain that students encourage high standards of expertise and currency among *all* laboratory staff members (and not just those who are principally responsible for teaching) and that an academic focus, especially in a teaching institution, is a desirable characteristic for a medical laboratory. As one clinical co-ordinator noted, the presence of students prompts technologists to stop and think about the work they are doing: to become conscious of the actions, a valuable opportunity to enhance work quality in an otherwise intense laboratory environment.

Clinical sites do gain a measure of prestige through their educational activities; one site displays its certificates as an accredited partner with the educational institution. A commitment to educational processes is highly valued in some organizational settings. At several sites, contributing to a competent workforce through teaching is seen as fulfilling a social responsibility (as well as serving the health care institution itself) and as enhancing the quality of the health professions.

As noted earlier, students make contributions to lessening the laboratory workload, the moreso the longer their placement experience. These contributions are difficult to quantitate and not all participants acknowledge them. However, one individual pointed out that, during a recent strike at her institution, students (from a number of health professions) were not permitted to cross the picket lines. The departments with which the students were associated noted such dramatic and negative impacts on their productivity that the institution declared its students to be ‘essential workers’ in order to permit them to cross the picket lines and resume their responsibilities.

And interestingly, two participants at different institutions noted that students facilitate their scheduling and distribution of workload. These institutions depend on the presence of students during the summer months to enable regular staff members to take holidays that might otherwise be impossible because of limited staffing.

- *A student is a second set of hands, a second source of input.* (laboratory director)

Clinical instructors

Clinical instructors expressed a great deal of enjoyment with the teaching process and the chance to share their professional knowledge and skills. They appreciated the modest acknowledgement mechanisms, where available, but many were quite satisfied with the intrinsic rewards alone. At sites where teaching technologists are designated because of their expertise, teaching technologists commented that they enjoy the recognition for this status. They felt that they gained valuable skills by teaching students in addition to whatever upgrading or professional development credits were available and felt pride at the responsibilities and sense of professionalism that it offered. They were glad to have an opportunity to shape future colleagues and their profession.

> *Having students helps keep technologists up-to-date. It actually helps them to troubleshoot ... They're more aware of the methodology. It's easy to forget some of the inner workings and processes because you can't see them… Teaching is a really powerful stimulus…Technologists get a little jaded sometimes … Students are like a shot in the arm.* (clinical co-ordinator)

Students

Students are certainly major beneficiaries of the clinical education process. Their hands-on skills and experience enhance their value to the workplace and permit them numerous opportunities to gain knowledge, skills, and professional attributes. Students appreciate the opportunity to work with proficient technologists and to learn about the medical laboratory profession in an authentic environment. They also report feeling excited to find that they are contributing to patient well-being through their work as students; clinical education appears to be a highly motivating experience and may have potential as a retention mechanism if offered reasonably early in a medical laboratory program. Their clinical experience and familiarity with the workplace facilitate their job search and may provide them with opportunities for part-time work in the laboratory prior to their graduation. For internationally-trained students, the Canadian workplace experience gained through clinical education is an essential prerequisite to professional certification in this country.

Educational programs

Educational institutions benefit from the presence of a clinical practicum element (as distinct from a simulated experience) as a significant recruiting tool for their medical laboratory programs. Students in this study reported that the opportunity to work in a real laboratory environment was a major factor in their decision to enter the program.

Educational institutions are accountable to students and to professional certification and accreditation bodies for their assessment of students' suitability as candidates for professional entry. Periods of clinical education are the sole means by which medical laboratory programs can determine the competency and suitability of their students for professional practice.

Health care system

The literature linking a competent medical laboratory workforce to quality of health care is poorly developed, although a fascinating study in the US found that increased numbers of medical laboratory technologists in hospitals were associated with lower hospital mortality rates (*and* that increased numbers of administrators were associated with *higher* patient mortality rates).[67] In general, research on the role of the medical laboratory in enhancing patient outcomes is highly deserving of greater attention. However, it has been acknowledged that a competent health professional workforce is essential to the delivery of quality health care.[68]

The algorithm considers only the tangible elements. It presents a range of values as identified by participants in the study in order to accommodate the broad variations observed. It is not intended to produce a final 'magic number' but merely to facilitate calculations by acknowledging the various points at which costs and benefits may be measured.

A SAMPLE CALCULATION

To demonstrate the application of this algorithm, the costs will be calculated for one clinical site of a hypothetical medical laboratory program with a 34-week clinical practicum for 5 students at that site. The figures used (i.e., for salaries) are random and do not represent recommended or ideal data. The model assumes that students are with a maximum of one instructor at any given time and, for ease of calculation, that all the co-ordinators and all the instructors earn the same salaries as their peers.

CLINICAL SITE COSTS – SAMPLE CALCULATION

STAFF TIME		
lab manager	45.0 x (38.50 + 6.93*)	2,044.35
5 clinical co-ordinators	937.5 x (28.25 + 5.05)	31,218.75
5 instructors (first 10 weeks)	.75 x 1,875 x (23.50 + 4.23)	38,995.31
5 instructors (second 10 weeks)	.50 x 1,875 x (23.50 + 4.23)	25,996.88
5 instructors (remaining 14 weeks)	.25 x 2,625 x (23.50 + 4.23)	18,197.81
human resources	10 x (23.00 + 4.14)	271.40
health services	4 x (23.00 + 4.14)	108.56
support staff	8 x (21.50 + 3.87)	202.96
EDUCATIONAL MATERIALS		
$250 per student		1,250
SPACE and FACILITIES		
100 square feet (50% use by students for 34 weeks)	$625/sq. ft/year x 100 x .50 x 34/52	20,432.69
MISCELLANEOUS MATERIALS		
$150/student		750
SUM FOR CLINICAL SITE COSTS		**$ 139,468.71**

* *Note:* Employee benefits amounting to 18% of the hourly wage are used here

Table 3: A partial application of the algorithm to calculating costs for a hypothetical clinical site. (*Note: cost data used here were mentioned by study participants)*

[67] Bond, C. A., Raehl, C. L., Pitterle, M. E., & Franke, T. (1999). Health care professional staffing, hospital characteristics, and hospital mortality rates. *Pharmacotherapy, 19*(2), 130-8.
[68] For example, the Romanow and Kirby reports cited earlier.

This partial calculation demonstrates the most complex portion of the algorithm, incorporating the stepped nature of the estimation of instructor time. A pause to appreciate the site-specific costs for this hypothetical situation reveals expenses to the clinical site of approximately $27,893.74 per student for 34 weeks, or $820.40 per week. However, as mentioned elsewhere in this report, these costs should not be considered without carrying the algorithm to completion and taking into account the benefits that will be gained by the site (for example, hiring three of these five students could save the institution $25,000 to $75,000 in recruiting, hiring, and employee orientation costs). Nor should this calculation be construed as endorsing these figures on clinical education costs for citation elsewhere.

SUMMARY

This last comment points to a final *caveat* about the use of this algorithm: it is the contention of this report that costs cannot be considered in a vacuum. They can be appreciated most accurately and most fully only when benefits for clinical placements are included, and further, only when both tangible and intangible elements are kept in mind. This limitation presents challenges for those who wish to reduce the discussions to dollar figures but it is founded in observations made throughout this study that there is more to clinical education than tangible costs alone. *Use of this algorithm solely as a tool for calculating costs in the absence of benefits or without considering both tangible and intangible elements should be considered a misuse of this material.*

CLINICAL EDUCATION AND STUDENT PERFORMANCE

At the time this study was proposed, it was hoped that a consideration of student success rates on CSMLS national certification examinations would provide some insight into the impact of differing clinical education models on student performance (i.e., to determine whether one model is better than another for preparing students). Even then, though, it was appreciated that written certification examinations present considerable limitations for drawing conclusions about the extent to which a graduate enters the workforce as a competent entry-level practitioner.

Since that time, it has become apparent through the investigations of this study that there are so many variables in play in the implementation of clinical education for medical laboratory technologists that it is impossible to use the data collected through this investigation to make correlations between clinical education model and student performance. One of the limitations has to do with the format in which data about student examination success rates is available to the CSMLS: pass rates are calculated as an aggregate for all students from a given program. However, any one educational program can consist of different implementation strategies that can result in different learning experiences for students from the same programs. The CSMLS does not have access to information about the clinical sites in which individual students experienced their practicum, so an aggregate CSMLS pass rate for one educational institution actually may mask differences in student achievement from one site to another within the same program. In fact, it is possible that students from one educational institution may actually have more in common with students from a different educational institution but who are placed in a similar clinical site than they do with other students from their own program.

An additional limitation is that pass rates on national certification examinations can be affected by factors that have nothing to do with clinical placement: for example, curriculum modifications for the didactic program can play a major role in influencing apparent pass rates, as can a small class size (where a failure of one student, for example in a class of four, could cause a drop of 25%). Furthermore, recent CSMLS examination statistics are for a period shortly after the CSMLS introduced its competency-based examination procedures. Educational programs adapted to this change at different rates and through varying curriculum modifications, which may be reflected in their pass rates.

In order to appreciate how these within-program differences affect student performance it would be necessary to conduct studies with the cooperation of educational institutions to track their students through their clinical sites and to document the characteristics of the clinical program (including such variables as the nature of the support offered by the educational institution, instructor teaching styles, time spent in rotations, evaluation strategies, and so on) and to eliminate fluctuations due to external influences such as didactic curriculum modifications. Only then would the data be sufficiently detailed to permit a valid appreciation of how clinical education experiences prepare students for their national certification examinations. And even then the question remains as to whether performance on national certification examinations offers any insight into how the student performs as a competent entry-level technologist. This latter information requires further research in the workplace by inquiring into employer, technologist and new graduate perceptions on the ease with which the new practitioner is able to integrate into the workplace.

To illustrate some of these challenges, Table 3 presents pass rates on general medical laboratory certification examinations for programs arranged according to the five models outlined in this study. The cytotechnology and clinical genetics programs are not included here because of their small class sizes; as well, in the case of cytotechnology programs, a 100% pass rate is the norm with only one exception among the data available for the 8 programs.

Model		1999 % Pass	2000 % Pass	2001 % Pass	2002 % Pass	2003 % Pass	Average Pass Rate
Model A	1	87	89	90	78	92	87.2
	2	65	64	88	76	96	77.8
	3	56	80	87	88	76	77.4
	4	87	73	63	72	88	76.6
	5	63	85	88	77	81	78.8
	6	75	87	83	47	78	74.0
	7	87	79	95	78	90	85.8
	8	70	60	67	62	71	66.0
	9	30	60	0	82	85	51.4
Model B	1	78	75	92	95	94	86.8
	2	100	100	89	94	100	96.6
Model C	1	94	93	92	78	93	90.0
	2	71	0	100	85	100	71.2
	3	*	69	80	74	89	78.0
Model D	1	93	100	100	93	96	96.4
	2	100	100	100	100	100	100
Model E	1	83	56	70	59	95	72.6
	2	100	68	100	100	100	93.6
	3	*	*	*	82	87	84.5

TABLE 4: Pass rates on CSMLS national general medical laboratory certification examinations for the years 1999-2003 for programs categorized according to the clinical placement models identified by criteria set out in Phase 1 of this study. (Pass rates are expressed as a percentage of the total numbers of students writing the national examinations.)

Programs in Model A (mid-range clinical placement lengths) might be said to show signs of inconsistent and problematic performance. However, they have other programmatic similarities in addition to their clinical placement models that could also be responsible for their uneven success rates. In addition, individual programs demonstrate fluctuations that may result from circumstances unique to that one institution. Programs in Model D (institutions affiliated with degree programs) would appear to have consistent and high pass rates, and institution B2 also performs well. Faculty members of some medical laboratory programs acknowledge that their institutions' pass rates are not what they would like. However, they also point out the numerous changes that medical laboratory curricula have undergone, some necessitated by workplace change, and see these as influential in their students' performance.

However, the manipulations necessary to fully analyze these differences are beyond the scope of this study and may, in the long run, be unhelpful. Not only do exam pass rates have an uncertain correlation with graduate suitability for the workplace, as mentioned previously, but other questions must be asked along with this kind of inquiry, including "What differentiates an acceptable pass rate from an unacceptable pass rate?" and "How might CSMLS examination setting and evaluation processes influence pass rates from one year to another?"

One U.S. study provides a clue relevant to the questions posed in this section of the report: it noted that the age of a medical laboratory technician program, the number of graduates from the program, and the length of clinical rotation showed weak correlations with students' scores on their registry examinations, while the number of didactic hours and the timing of the rotations at the end of the program showed stronger correlations.[69] These correlations remain to be validated in a Canadian setting.

SUMMARY

It is disappointing to find that this study cannot comment on the success of the differing clinical placement models in preparing students for the workplace. It is quite likely that the most advantageous site for determining this is the workplace itself, and this, like many other types of research in the medical laboratory, is an underexplored area.

[69] An investigation of the relationship of clinical and didactic hours of medical laboratory technicians and scores on the Board of Registry examination. Unpublished PhD thesis. Ohio University.

RECOMMENDATIONS

The recommendations made in this report are intended to centralize clinical education of medical laboratory technologists as a long-term conscious education strategy. They affirm the importance of clinical education and address five major areas of concern: Accountability, Communication, Student/Site Fit, Valuing Education, and Research.

1. ACCOUNTABILITY

The following recommendations address the concerns voiced about the lack of accountability observed in the clinical placement processes examined in this study:

1A	*Targeted funding for clinical education of medical laboratory technologists* The source of this funding will be identified through recommendation 1B, the amounts to be determined by application of the algorithm outlined in this report and validated through ongoing research on clinical education practices as suggested in Recommendation 5. Supporting programs already in place and providing them with the capacity to accommodate more students will increase the capacity of the educational system and address labour force shortages.
1B	*Development of explicit structures linking health and education policy for health professions like medical laboratory science whose educational processes cross ministerial and provincial boundaries* This process would include the explicit assignment of responsibility for the funding of all aspects of the educational process. The agreement in place in Quebec can serve as a model elsewhere in the country.
1C	*Improved mechanisms for tracking and fine-tuning the fit between educational programs and human resources needs to avoid surpluses and shortfalls in the workforce* This should be a collaborative effort among educational institutions, professional associations, and government ministries. There is some indication that these human resources-focussed measures are underway, an example being a recent proposal by CIHI.[70]
1D	*Ensuring timely responsiveness to the data collected on human resources issues.* Response mechanisms must be anticipated and laid out to ensure prompt action when data reveal sub-optimal human resources issues (i.e., impending workforce shortages).
1E	*Creation of accountability mechanisms for use of funds paid to health care facilities* Compensation for clinical education MUST benefit those most directly affected by the responsibilities of clinical education. This demands responsible, appropriate, and equitable allocation of funds. It is reasonable to expect educational institutions to require this accountability as part of the agreements they make with their clinical sites.

[70]Murphy, G. T. & O'Brien-Pallas, L. (2004). The development of a national minimum data set for health human resources in Canada: Beginning the dialogue. Working document: August 2004. Canadian Institute for Health Information: Ottawa.

1F	*Establishment of protocols for clinical processes that create some measure of consistency of learning experiences for students and create clear guidelines for the roles and responsibilities of teaching technologists and coordinators* This responsibility is shared among educational institutions, their clinical sites, the accrediting body for medical laboratory programs, and possibly the CSMLS.

2. COMMUNICATION

These recommendations focus on the incomplete lines of communication noted throughout the study.

2A	*Improving and centralizing communication to and among medical laboratory educators, practitioners and policy-makers about educational issues.* This can be achieved, in part, by the CSMLS in two main ways: (1) enabling a more central place in society-wide venues, such as the annual Congress and the national professional journal CJMLS, for addressing educational issues; and (2) supporting the work of educator-driven networks such as CAMLE. Educational institutions also share in the responsibility of encouraging their educators to maintain strong links with their colleagues across institutional, regional, and professional boundaries.
2B	*Ensuring that research relevant to professional education is communicated among medical laboratory educators and practitioners.* The dearth of research on Canadian medical laboratory education and the relative isolation of educational programs confers a great responsibility on the educators, educational institutions and the CSMLS to seek out and share relevant research, whether personal, institutional or international, among their fellow professionals.
2C	*Creating collaborative information-sharing networks among stakeholders in the clinical education process.* Information-sharing among educational programs, clinical sites, and government bodies may generate collaborative ventures such as BC's HPnet, which, in turn, creates an institutionalized and visible presence for health professional clinical education and may increase the likelihood that its issues are included in decision-making processes.

3. THE STUDENT/SITE FIT

These recommendations address the needs of underserved communities for competent medical laboratory graduates.

3A	*Actively recruiting students from underserved areas to study in medical laboratory programs and return to their home areas for clinical education and eventual work.* This recruitment would be enhanced with scholarships, bursaries, and other forms of support for students living away from home during the educational process.
3B	*Linking clinical education 'privileges' to post-graduation work requirements in underserved areas.* This would include the availability of educational bursaries conditional upon the student's commitment to work in an underserved area for a predetermined length of time. Failure to carry out the commitment would necessitate the student's repayment

	of the bursary.
3C	*Creating satellite campuses or modified distance-education models in underserved areas for existing medical laboratory programs.* These options permit students to pursue a large portion of their education in their home town with pre-arranged opportunities for hands-on experience in nearby facilities and occasional relocation to the central education institution for formal training periods.
3D	*Developing long-term plans for investing in a flexible and geographically diffuse education system for medical laboratory technologists* Educational planning must take into account the needs of regions of the country currently underserved by medical laboratory programs as well as the need for educators to work in these programs. This may include the establishment of new programs.

4. ACKNOWLEDGEMENT

These recommendations speak to the lack of recognition accorded to the educational preparation of medical laboratory technologists and to those who carry out educational processes, particularly during the clinical education experience:

4A	*Creating a professional environment that values teaching and sharing of professional knowledge and skills by practitioners* The CSMLS can accomplish this by (1) evaluating its role in affirming the importance of educational practices; (2) situating education in its publications and practices as a professional value and a responsibility for the society and for practitioners. Educational institutions can strengthen/expand their acknowledgement mechanisms for the teaching technologists at their sites.
4B	*Encouraging/enabling clinical sites to institutionalize acknowledgement mechanisms (both material and symbolic) for teaching activities* These mechanisms include offering teaching premiums, unique job categories for teaching technologists, release from bench duties, and availability of casual staff to ease workload. They depend upon the provision of support through targeted funding mechanisms mentioned in Recommendation 1.
4C	*Creating clearer links between clinical teaching activities and the educational institution* Educational institutions can acknowledge their clinical partners through greater integration of clinical teaching technologists into the educational program, i.e., through provision of educational resources (including workshops and reading materials), creation of interim appointments or cross-appointments of clinical staff as didactic instructors, and developing opportunities for didactic teaching staff to work in clinical environments.

5. RESEARCH

Addressing the lack of research to inform decisions on clinical education and other health profession issues may begin with these recommendations:

5A	*Encouraging/supporting research on medical laboratory education and practice.* Worthwhile topics include inquiry into after-graduation assimilation patterns of MLT students into the workplace, measures of student and graduate outcomes and their relationship to clinical education experiences, geographical movement of medical laboratory graduates and practitioners, the pedagogical validity of the various strategies used in medical laboratory education in the clinical site, attrition in medical laboratory programs, the impact of program selection processes on program attrition and success rates, the relationship between patient outcomes and a competent medical laboratory workforce, and the dissemination of successful and 'best' practices in medical laboratory education. Ideally, this research would be carried out by medical laboratory technologists themselves, but in the absence of qualified researchers, individuals outside the profession could begin this much-needed process. Funding support and expertise provided by government agencies would assist this process. The availability of such support can serve as a major motivator for educational research and makes a significant statement about the perceived value of health professions.
5B	*Creating a central database of research that will inform decision-making processes* Previously unreleased reports and materials of limited circulation may inform discussions about clinical placements and prevent costly duplication of effort. Federal and provincial organizations with access to or control of such information should encourage prompt and wide dissemination of such information.
5C	*Ensuring that the call for research does not serve as a substitute for action* While evidence-based decision making is advisable, it should be combined with interim and *ad hoc* measures where situations will benefit from immediate intervention. When recommendations of research studies are made available, responses and action should be prompt and appropriate. Decision making bodies would be wise to avoid the 'paralysis of analysis'.

CONCLUSION

The clinical education of medical laboratory technologists is carried out by a large number of dedicated educators and practitioners who have been working with dramatically shrinking resources and support. Poor patterns of communication, limited accountability measures at various levels (including inadequate financial support), lack of availability of relevant data and research, and a professional ambivalence about the place of educational responsibilities hamper efforts to continue the tradition of graduating competent laboratory professionals and to meet the needs of the laboratory workplace. An insufficient number of clinical places is not the sole bottleneck (although it is a major one); also implicated in clinical education difficulties is the lack of students in sites where they're needed, the unreliable nature of clinical placements, and high or unpredictable attrition rates from programs.

The information gained from this study and the recommendations that have resulted are only a beginning to acknowledging and addressing the challenges currently besetting medical laboratory education. The difficulties facing clinical education of medical laboratory students go deeper than can be solved by narrow calculations of the costs involved. Doling out carefully tabulated sums of money to clinical sites will not magically create more clinical places for students: there are deeply-embedded structural obstacles to clinical placements that will resist further expansion unless they are addressed at the same time.

This study did not include inquiry on comparative cost-effectiveness of the various strategies for clinical education in medical laboratory science. However, in light of the observations made through this study about the existing infrastructure for clinical education as seen in the responses those most closely involved in the process, it would appear that the current strategy for preparing competent medical laboratory technologists may well be the most cost-effective and pedagogically worthwhile means, although much remains to be determined about optimizing the process (i.e., with respect to an effective duration). Addressing this issue requires decisive action and long-term commitment by multiple stakeholders.

It is the contention of this report that the preparation of a competent health professional workforce is seriously undervalued, hence its relegation to *laissez-faire* policy processes and lack of presence in research on health human resources issues. It appears that the health and education systems have not maintained a commitment to this process and that they are seriously underinvested in this operation to the detriment of the health care system. There seems to be is a fundamental tension between notions of cost and value. It may well be that the most critical question about clinical placement is not "What does it cost to produce competent health professionals?" but "What is it worth to the health care system to have competent health professionals?" Once decision- and policy-makers address the question about the value of health professionals, the costs of educating them will be more readily tackled.

APPENDIX A

GLOSSARY OF TERMS USED IN THIS REPORT

Because there is a great deal of variation in the terms used for various aspects of clinical education, the following definitions clarify terms used in this report. The definitions here do not necessarily match uses in all locations.

Bench technologist: a medical laboratory practitioner with analytical laboratory responsibilities. This individual may or may not have teaching responsibilities.

Clinical instructor: a medical laboratory technologist with specific responsibilities for teaching students. This individual also has responsibilities for laboratory analyses. This term is used here interchangeably with ‘teaching technologist’.

Clinical co-ordinator: a medical laboratory technologist, often at a more senior level of the laboratory, who has responsibilities for planning, scheduling, and organizing clinical rotations and also for orienting students to the various areas/protocols/practices in the laboratory. Each laboratory department may have its own co-ordinator. The co-ordinator may be an employee of the clinical site or of the educational institution, or may be seconded from the clinical site and paid by the educational institution for the duration of the clinical placement.

Clinical placement: the assignment of a medical laboratory student to one or more clinical sites to experience the clinical laboratory environment and to be provided with an opportunity to carry out procedures that will enable him/her to complete required competency-based activities in order to graduate from the program. The clinical education experience is often also referred to as a ‘practicum’.

Clinical site: The health care institution housing the laboratory where students experience their rotations is also referred to in this report as a ‘clinical institution’ or ‘clinical partner’.

Didactic education: this refers to the time spent by the student in the educational institution.

Program director: Although exact titles vary, this title is used for individuals at the educational institution who have the main responsibilities for the medical laboratory program.

Rotation: The clinical education period for general medical laboratory students is typically divided into five or six segments (‘rotations’), each of which exposes the student to a department or sub-specialty of the laboratory (for example, chemistry or microbiology). For cytotechnology and clinical genetics students, these rotations will obviously involve experiences relevant to those specialty areas.

APPENDIX B

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COSTS AND BENEFITS OF CLINICAL PLACEMENTS IN THE HEALTH PROFESSIONS

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APPENDIX C

FINDINGS OF PHASE 1

CLINICAL PLACEMENTS FOR MEDICAL LABORATORY TECHNOLOGISTS
COSTS, BENEFITS AND ALTERNATIVES

REPORT ON PHASE 1

A REPORT SUBMITTED TO HEALTH CANADA
MARCH 31, 2004

Submitted by the Canadian Society for Medical Laboratory Science

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EXECUTIVE SUMMARY

This report presents the findings of the first phase of a research project designed to gather much-needed data on the clinical placement models in use in Canadian medical laboratory programs. The data gathering and analysis and report production for this study is being carried out by the Canadian Society for Medical Laboratory Science and is funded by Health Canada.

Although some limited information is available on clinical placement in medical laboratory programs, this study has begun the task of creating a comprehensive central database for medical laboratory educational programs in Canada, with a focus on identifying the models for clinical placement that are currently in use. It includes tables that present the salient details about each program, including the number of student places in clinical settings, the lengths of clinical education experiences, the use of simulated experiences, instructional staff and strategies, and the compensation of clinical sites and personnel. In addition, the report presents other, related data, including information on the didactic (in-class) portions of the programs.

This report also discusses the feedback of survey respondents on issues related to the costs and benefits of clinical placements. The participants in this survey, medical laboratory program directors, readily acknowledge the considerable costs associated with the clinical training of their students. Nonetheless, these respondents indicate that they consider clinical education to be an essential component of the preparation of medical laboratory technologists. They suggest that the lack of clinical places for their students is a principal factor in the inability of their programs to expand to meet current and future human resources demands.

With this information, the study has permitted the identification of 5 models for clinical education. It has also called upon the expertise of medical laboratory program directors to identify the costs and benefits of clinical education. Both of these will be used to guide the second phase of this study, which investigates the costs, benefits and alternatives that can be ascribed to clinical education. Using this information, ten clinical education sites (and alternatives) have been identified for follow-up research: subject to the approval of the laboratory directors, five sites are to receive written surveys directed to laboratory directors, clinical instructors, and medical laboratory students; five sites will be visited by the principal investigator for the purpose of conducting interviews with laboratory directors, clinical instructors, and medical laboratory students.

INTRODUCTION

Purpose of the Study

A number of sources have noted that the medical laboratory workforce is in the early stages of a deepening human resources shortage. One of the main factors cited in this shortage is the insufficient number of graduates from medical laboratory programs. While it would seem logical to simply expand the present programs to produce graduates in sufficient numbers, this is not readily accomplished: a key component of these programs has traditionally been the clinical education placement experience, which consists of a period of apprenticeship-like supervised practice in a laboratory setting. Despite pressures to increase the class sizes of educational programs, educators have found this difficult, if not impossible, because of a lack of sites in which to provide their students with the clinical education necessary to provide them with the required competencies for entry into the profession and to qualify them to write the national certification examinations. There is agreement among educators that clinical education is an essential component of the education of medical laboratory technologists. Directors of potential clinical sites appear to be reluctant to accommodate students at all, or to take on more students than they already have. In the meantime, workforce shortages of medical laboratory technologists worsen.

This report is not intended to discuss this situation in detail. A more detailed analysis is planned for the final submission of this study in September 2004. However, it has become apparent that there are wide variations in the ways that medical laboratory programs have implemented their clinical placement strategies and that it is difficult for the participants in the clinical placements dialogue to speak knowledgeably about resolving the issue without a fuller appreciation of the mechanisms that are already in place.

This two-part study informs the discussions about clinical placements by gathering information on medical laboratory programs, and on their clinical placement practices in particular. It assembles data on the costs and benefits of these educational experiences and examines alternative formats in use. Finally, in recognition of the possible impact of differing clinical placement experiences on the learning experiences of students, this project correlates the type, or 'model', of clinical learning experience with student performance on the certification examinations of the national professional association and with student performance during their clinical experiences as reported by laboratory directors, clinical instructors, and the students themselves. The research questions guiding the larger study are as follows:

1. Which models for clinical placements are currently in use in Canadian medical laboratory programs?

2. Do the different models for clinical placement produce discernible and significant differences in student performance?

3. What are the costs and benefits of (and possible alternatives for) clinical placements in the education of Canadian MLTs?

Outline of the Study

This study consists of two parts: the first phase, on which this document reports, took place in February and March 2004 and consisted of mailed surveys to the program directors of the 36 medical laboratory programs in Canada. With the understanding that all aspects of an educational program can influence the nature of the clinical experience, this survey (see Appendices B and C) posed detailed questions on both the didactic (educational institution) and clinical (health care site) implementation of each program. It also offered program directors an opportunity to contribute to a list of the costs and benefits associated with clinical education as seen in the education and health care literature. This phase of the study has resulted in the creation of tables presenting the salient features of each program's clinical education process (Tables 1 to 5, Appendix A), a validation of the costs and benefits that should be addressed in Phase 2, and a means of classifying the various programs to enable targeting potentially informative sites for follow-up analysis in Phase 2.

Phase 2 will address its questions about clinical education (costs, benefits and perceived outcomes) to those directly involved in its on-site implementation: laboratory directors, clinical instructors, and medical laboratory students. At five of the selected sites, this inquiry will take the form of written surveys; at an additional five sites, the principal investigator will visit the site, interview the three main groups mentioned above, and will observe, where possible, the clinical instructors as they work with their students in the laboratory setting.

This report presents the findings of Phase 1 of the study. Data collection for Phase 2 will be conducted in the spring of 2004, with data entry and analysis in the summer of 2004 and submission of the final report at the end of September 2004.

DATA GATHERING AND ANALYSIS

The Survey

The survey consisted of 41 questions on various aspects of medical laboratory educational programs (see Appendices B and C). It was mailed to 36 program directors in programs encompassing general medical laboratory, cytotechnology, clinical genetics, and bridging programs for laboratory assistants and graduates of international medical laboratory programs. The questions addressed issues of program and subject rotation length, curriculum formats, timing of clinical placements, class sizes, compensation of stakeholders, and perceived costs and benefits of the clinical placement experience.

Despite repeated follow-up attempts to contact certain program directors by e-mail and by telephone, the responses of two MLT programs and one cytotechnology program are not yet available. A number of other responses required follow-up contacts to clarify missing or incomplete information; there are still some information gaps that could not be resolved in the time available for the preparation of this report. The missing information has minimal impact on the conclusions reached in this report but will be pursued nonetheless to permit an updated and more complete version of this report to be submitted at the time of submission of the Phase 2 report.

The Sample

Medical laboratory programs prepare students to work in three main disciplines: general medical laboratory technology, cytotechnology, and clinical genetics. There are 33 full-time Canadian post-secondary programs involved in these disciplines. In addition, there are three somewhat 'non-traditional' programs, referred to as 'bridging programs' for the purposes of this study, which facilitate the professional entry of individuals with partial credentials in the medical laboratory field. All of these programs are described briefly here:

General Medical Laboratory Programs

British Columbia Institute of Technology (BCIT), Burnaby BC: This is a 25-month diploma program.

Northern Alberta Institute of Technology (NAIT), Edmonton AB: A two-year diploma program.

University of Alberta, Edmonton AB: four-year degree program (Bachelor of Science in Medical Laboratory Science)

Saskatchewan Institute for Applied Science and Technology (SIAST), Saskatoon SK: two-year diploma program.

Red River College, Winnipeg MB: two-year program with a required 'pre-professional' year and linked to a degree program at the University of Manitoba

St. Clair College of Applied Arts and Technology, Windsor ON: three-year diploma program which is linked to a four-year concurrent degree-diploma course at the University of Windsor.

The Michener Institute for Applied Health Sciences, Toronto ON: three-year diploma program
St. Lawrence College of Applied Arts and Technology, Kingston ON: three-year diploma program
Cambrian College of Applied Arts and Technology, Sudbury ON: three-year program, begun in the fall of 2003, which has not yet been through the accreditation process for medical laboratory programs, and which has not yet sent students through a clinical placement experience.
Cegep de Chicoutimi, Chicoutimi, QC: three-year diploma program
Cegep Dawson, Westmount QC: three-year diploma program
Cegep de Rimouski, Rimouski QC: three-year diploma program
Cegep de Rosemont, Montreal QC: three-year diploma program
Cegep de Saint-Hyacinthe, Saint-Hyacinthe QC: three-year diploma program
Cegep de Saint-Jean-sur-Richelieu, St-Jean-sur-Richelieu QC: a three-year diploma program
Cegep de Saint-Jerome, Saint-Jérome QC: a three-year diploma program
Cegep de Sainte-Foy, Québec QC: three-year diploma program
Cegep de Shawinigan, Shawinigan QC: three-year diploma program
Cegep de Sherbrooke, Sherbrook QC: three-year diploma program
New Brunswick Community College, Saint John NB: 2 year diploma program
Université de Moncton (CNB-Campbellton), Moncton NB: three-year diploma program
College of the North Atlantic, St. John’s NL: three-year diploma program

Cytotechnology Programs
British Columbia Cancer Agency (BCCA), Vancouver BC: a 23-month diploma program.
Northern Alberta Institute of Technology (NAIT): Edmonton AB: a 2-year diploma program.
Regina Health District School of Diagnostic Cytology, Regina SK: This 18-month diploma program requires general medical laboratory certification. The program is in its final year at the current site and in the current format and is relocating to the Saskatchewan Institute of Applied Science and Technology.
Saskatchewan Institute of Applied Science and Technology (SIAST): a new 43-week program
Winnipeg Health Sciences Centre/School of Cytology, Winnipeg MB: a 19-month diploma program.
The Michener Institute for Applied Health Sciences, Toronto ON: an 18-month diploma program.
College de Rosemont/Centre hospitalier de l’Université de Montréal, Montréal QC: details of this diploma program are not known at this time.
Hopital Hotel-Dieu de Montréal, Montréal QC: A 39-week diploma program
QEII/Dalhousie School of Health Sciences, Halifax NS: a four-year degree program (Bachelor of Health Sciences) with a diploma exit possible after three years.

Clinical Genetics Programs
British Columbia Institute of Technology, Burnaby BC: for admission to the program students must have a BSc in cell biology with a major in genetics. Accreditation for this 13.5 month program is pending.
The Michener Institute for Applied Health Sciences, Toronto ON: a 15-month program

Bridging Programs

Southern Alberta Institute of Technology (SAIT): this program has been designed to meet the needs of graduates of SAIT and NAIT laboratory assistant and combined laboratory/Xray technician programs who would like to qualify for national certification examinations in general medical laboratory technology.

The Michener Institute for Applied Health Sciences: a program intended to offer graduates of international programs in general medical laboratory technology an opportunity to familarize themselves with the Canadian work environment and requirements for the national certification examinations; the program is highly flexible: program admission, timing and format are adjusted to meet the needs of individual clients, who undergo prior learning assessment (PLA) processes to determine eligibility for the program.

Mohawk College of Applied Arts and Technology, Hamilton ON: this program serves the same purpose as the Michener bridging program but with a somewhat more structured format.

Data Entry

Numerical and ordinal or single-word data were recorded using the application SPSS (Statistical package for the Social Sciences). Short answer responses were recorded and coded manually in text form.

Challenges Encountered in Gathering/Analyzing this Data

These challenges arose from the diversity and ongoing differentiation of medical laboratory programs and presented challenges in seeing patterns and commonalities among the various programs' implementation strategies for clinical placements:

1. Encompassing the medical laboratory specialties: the different specialties in medical laboratory programs include general medical laboratory, cytotechnology, clinical genetics, laboratory assistants, and bridging programs for international graduates.
2. Within-program variations: for example, several programs include both diploma and degree options; two programs share clinical sites;
3. Programs in transition: several programs are in transition: a few are just getting under way, some are developing new curricula or adapting their clinical education models, and at least one is amalgamating with another program
4. Differences in titles and terminology: there are at least 11 different names used for clinical instructors in laboratory programs with multiple terms used within programs; in addition, the principle researcher experienced some challenges with variations in French terminology. These necessitated contacting the French programs to clarify the questions and request the relevant data. Not all programs have responded to these requests.
5. The sporadic and delayed responses to this survey: responses were still being received at the CSMLS offices at 2 p.m., March 31, the day this report was to be submitted.

SURVEY RESULTS AND BRIEF DISCUSSION

Data on Clinical Placements

The findings on the clinical placement portions of the programs are presented in Tables 1 through 5 (Appendix A, pages 22 through 33). They are discussed here on a table-by-table basis.

TABLES 1A and 1B: Overall Program Details for Clinical Placements
Tables 1A and 1B present general characteristics of each program, including the total number of weeks in the entire program, the number of weeks that students spend in a clinical placement (‘clinical weeks’), the number of student places available to the program (‘places’), the number of students placed in clinical sites for the 2003-4 academic year (‘students’), the number of laboratory sites participating in the program (‘sites’), and the use of multiple sites (‘multiple sites’).

Total program weeks and weeks of clinical placement (‘clinical weeks’)
The immense program variations are evident in the table for the general programs: the total lengths of programs vary from 75 to 120 weeks (the latter being a four-year degree program). The lengths of clinical placements vary from 12 to 45 weeks. These data benefit from closer examination (see Figure 1).

Weeks	Number of Programs
12	1
15	1
26	9
28	1
35	1
40	2
42	2
44	1
45	3

Figure 1: Frequencies of varying lengths of clinical placements.

This data suggests that there are three distinct categories for lengths of clinical placements: those that are less than 20 weeks (and these encompass the two programs that, as will be seen, involve considerable use of simulated laboratory settings as an alternative to placement in a clinical setting); those that are between 25 and 30 weeks (nine of which are Québec Cegep programs); and those that are longer than 34 weeks. These three categories will be significant in terms of the identification of ‘models’ for clinical placements, to be discussed later.

In terms of length of clinical placements for the cytotechnology programs, a similarly broad distribution is evident, with a range between 18 and 50 weeks. To align with the general medical laboratory programs, the cytotechnology programs might reasonably be grouped as involving less than 34 weeks or more than 34 weeks. The two clinical genetics programs differ widely as well, with one program reporting a clinical education period of 18 weeks and the other 36 weeks. There is no immediately apparent rationale for the wide differences; these require further investigation in Phase 2 of the study.

The Mohawk bridging program for international graduates uses an 18-week clinical placement, while the SAIT bridging program for laboratory assistants has implemented a 36-week process. The Michener bridging program for international graduates involves a variable-length clinical placement model designed to meet the needs of the individual client and to address the requirements for clinical experience as specified by the Ontario regulatory body (the College of Medical Laboratory Technologists of Ontario, CMLTO). These bridging programs meet unique needs and may need to be considered independently of the other programs.

Numbers of clinical places available and students assigned to clinical places
In terms of the total capacity for clinical placements, respondents for the general medical laboratory programs reported that there are a total of 553 clinical places available across the country (bearing in mind that there are three programs that did not respond in this category). Several programs suggest that these numbers may increase slightly in the coming years as a result of current recruiting measures. These programs are operating at approximately 82% of capacity. Cytotechnology programs report 77 available clinical places (with two non-responding institutions), with 79% of the places filled, and clinical genetics programs have 25 places available which are occupied by 23 students (92% of capacity). The bridging programs report a total of 59 clinical places, of which 54 (92%) are occupied. The fact that some of the places are not currently occupied does not necessarily reflect an underutilization of available resources. Rather, it is more likely an indication of the difficulties of anticipating attrition of students in any given year and of the need to build in a certain amount of flexibility to allow for the possible withdrawal of sites on short notice.

Numbers of clinical sites and use of multiple sites
In general medical laboratory programs, the use of a single clinical site is reported only for one institution where the class size is extremely small (6 students). Larger class sizes require the involvement of many clinical sites.

The use of multiple sites (a situation where students must work in multiple sites over the course of their clinical education in order to acquire experience with the full range of skills) is fairly common, with more than half (56.3%) of medical laboratory programs reporting this practice, six out of seven cytotechnology program, and both clinical genetics programs utilizing multiple sites for their students. This practice varies for the bridging programs. The need for students to visit multiple sites in the course of their clinical placement has become more frequent with restructuring of laboratories: where it was once common for most laboratories to offer a full range of testing that would address the needs of students for exposure to the required skills, regionalization and relocation of laboratory services mean that not all laboratories perform all procedures, and students must work at multiple sites in order to fulfill the criteria for completion of their clinical rotations.

TABLES 2A and 2B: Clinical education program implementation

Tables 2A and 2B present three major aspects of implementation of clinical placement programs: the point in the program at which the clinical placement takes place (‘timing’). This may occur at the end of the didactic phase, it may be staggered (split up and spread out throughout the program) or fully integrated. These tables also report on the use of simulated laboratory experiences (‘simulated labs’) and the availability of additional learning experiences for students that are not part of their scheduled program while they are at their clinical sites (‘additional student activities’).

Timing of the clinical placement in the program

The ‘end-of-didactic’ model for timing of clinical placements appears to dominate in medical laboratory programs. More than half of all programs use this timing, while a staggered timing is in use in about one-quarter of the programs. One program reports a ‘fully integrated’ format, in which didactic and clinical activities are simultaneous; this results from the program’s location at one site. It should be noted that this cytotechnology program is being re-located shortly to another educational site where the full integration model will be discontinued and the clinical experience moved to the end of the program. The fully-integrated model is reminiscent of, and probably originates in, the original apprenticeship-type training that characterized most medical laboratory programs prior to the relocation of most of these programs into community college settings in the 1960s and 1970s.

The use of simulated laboratory learning experiences

One-third of general medical laboratory programs report using simulated experiences to some extent; two programs make extensive use of simulations. The impact of this use is reflected in the decreased lengths of their clinical programs when compared with the lengths of programs with little to no simulated clinical experiences. Simulated clinical experiences are not used in nine of the general programs while two note that it varies with the site. Only one of the seven cytotechnology programs use simulations; another notes that it varies with the site. One of the two clinical genetics programs reports use of simulations and none of the bridging programs report this strategy.

There appears to be some irregularity in respondents’ definitions of ‘simulated experience’, which necessitates further clarification in Phase 2 of the study: ‘simulation’ can refer to an extended period of learning activity at the educational site in which the tasks and environment are manipulated to resemble those of the clinical environment; or it may be used to denote brief exercises in a clinical site involving on-site resources that are not part of the workload and data production of the laboratory. The first definition of simulations requires further investigation in terms of its use in the educational site as an alternative to clinical site experiences. That such applications may simply shift the costs of medical laboratory education from one site to another (thereby necessitating large-scale didactic program modifications and increased funding requirements for educational institutions) must be borne in mind.

Additional student activities
The reported variations in additional activities in which students participate during their clinical placement attest to the widely differing clinical experiences to which medical laboratory students are exposed. It is difficult to comment further on this feature as there is little research on the contributions of such experiences to the overall quality of clinical placements.

TABLE 3A and 3B: Teaching personnel in the clinical setting
These tables present the data on those who teach during clinical placements: how they are known ('instructor title'), by whom they are employed ('affiliation'), the types of instructional assistance they offer ('guidance provided'), and the types of instructional resources and support to which they have access ('resources/support'). Although some respondents noted instructor:student ratios ranging from 1:1 to 1:4, these were not reported sufficiently consistently by all respondents to be helpful at this point in the study.

Instructor titles
The variations in instructor titles were referred to earlier, and may create some confusion in discussions about the responsibilities of clinical instructional personnel. Not only do these titles vary from one program to the next, but they may also differ from one clinical site to the next within the same program. As well, some programs differentiate levels of teaching responsibility, assigning one title to an individual who oversees the entire clinical placement process from those who do at-the-bench teaching.

Instructor affiliation
Almost all clinical instructors are considered to be employees of the clinical site (and thus the cost of staff teaching time accrues mainly to the site). In one program, clinical instructors also have responsibilities as instructors in the didactic program. The rationale and potential benefits of this process merit further investigation in Phase 2. In another program (which is located at a university health centre), didactic and clinical sites are sufficiently integrated as to permit shared responsibilities of instructors at both sites.

Guidance provided and available resources/support
As for the guidance provided by clinical instructors, direct supervision is the most common activity of instructors. They also offer review sessions and quizzes or tests, including competency testing of practical skills. In terms of the support they receive for their teaching responsibilities, program directors note that some clinical instructors have access to learning and evaluation materials, course or competency manuals, and other relevant documentation. Some educational institutions make teaching workshops available for their clinical instructors. At some sites, clinical instructors are released fully from their responsibilities for bench work (regular laboratory duties) enabling them to focus on instructional tasks. Considering the importance attributed to clinical education for medical laboratory students, the support provided for teaching activities during this phase appears to be rather uneven. Comments discussed later in this report about the costs of clinical placements refer to the stresses involved for teaching technologists who must manage their laboratory duties in addition to teaching responsibilities. In addition, several program directors acknowledged the need to provide more support for their clinical instructors.

TABLES 4A and 4B: Rotation lengths (in weeks) through the subject areas

Medical laboratory students typically spend periods of time ('rotations') in differing parts of the laboratory where they will have an opportunity to acquire needed skills. The variations in timing for these rotations are consistent with the overall variations noted in the lengths for the clinical placements in general. For general laboratory programs and the bridging programs, the rotations are split into the five traditional subject areas ('chem', 'hem', 'micro', 'transfusion medicine', and 'histology'). Some programs reported other rotations as well. The cytotechnology programs reported their rotations in varying ways, some including preparatory skills ('prep'), gynecological studies ('gyn') and fine needle aspiration ('FNA') activities. The clinical genetics programs both divided their clinical programs into molecular genetics and cytogenetics rotations. ('FSH' refers to the technique of fluorescence *in situ* hybridization.)

TABLES 5A and 5B: Financial remuneration mechanisms

As this study deals with costs and benefits of clinical placements, the survey to program directors attempted to identify instances of compensation for services. This included payments to instructors ('instructor remuneration') or to clinical sites ('clinical site remuneration') and tuition paid by students ('tuition'). Respondents were also asked if their students were paid for any part of their clinical placement experience (once a practice in some laboratory programs) but none reported this practice, although one program director commented that certain transportation costs might be covered under special circumstances. It is worth noting that some programs involve no tuition fees for their students, or payment of nominal student activity-type fees, which might be interpreted as a subsidy of sorts. The origins of this no-tuition practice were not uncovered by this survey so it is unknown at this point whether it is a traditional feature of the program/institution (although the Québec Cegeps have traditionally involved little or no tuition), or if it is has been implemented as a short-term recruiting mechanism to address human resources shortages. It is worth noting that one program (the Mohawk bridging program) involves what appears to be a dollar-for-dollar 'turnaround' of the $160/week fee paid by the students to the college: although students nominally direct their payments for clinical education to the educational institution, the educational institution, in turn, pays the clinical site the same amount. In effect, the students are paying their own clinical education fees. The Michener bridging program appears to operate on a similar basis, although the exact sums differ slightly.

Instructor remuneration

With respect to remuneration of clinical instructors, only BCIT and the Cegeps de Sainte-Foy, Shawinigan, and Sherbrooke reported any salary-related payments: it remained to be clarified whether the Cegep situations involve direct payments to the instructor or simply payments made to the clinical site to contribute to the instructor's salary. The Michener Institute has a consistent policy of crediting instructors (at least, those who coordinate the student placements) with funds directed toward professional development courses at the institute. Other program directors also mentioned elsewhere in the survey that clinical instructors have access to teaching workshops as part of the support offered to those involved in clinical site teaching.

Remuneration of clinical sites

The practice of compensating clinical sites for the students they host is unevenly implemented. It would be interesting to inquire into the sums that have been settled upon in cases where clinical sites are remunerated: these range from $160/ week to $350/week (soon to be discontinued) to an undisclosed amount that apparently is in operation in Quebec as part of an agreement between the provincial ministries of Education and Health.

Student tuition
As noted earlier, student tuitions vary widely. All student tuition and fees reported by program directors are paid to the educational institution.

<u>Data on Didactic Programs</u>

Although not immediately pertinent at this stage of the project, the survey also collected information from program directors on their programs' didactic phases. Not only does this information enhance the database being assembled on medical laboratory programs, it may prove relevant in discriminating among programs once the student outcomes data is considered: it is possible that there are aspects of programs (such as admission requirements, retention rates, or curriculum models) that will shed light on student outcomes that are unrelated to the practices observed in the clinical placement part of the programs. These data are presented in tables 6A, 6B, 7A, 7B, 8A and 8B (Appendix A, pages 34 through 39). Although these findings are not discussed in any detail at this point, they are presented here to demonstrate the breadth of data available for consideration at a later point in the project.

TABLES 6A and 6B: Program entry requirements and selection processes
Academic entrance requirements ('entry requirements') are fairly similar across the general medical laboratory programs, although there are programs that have specified university-level credits or completion of a full year of university prior to entry to the program. In addition, it should be noted that the Michener reports Grade 13 course credits, which will, no doubt, be modified with the discontinuation of the province of Ontario's fifth year of high school. Entry requirements for many of the cytotechnology and clinical genetics programs involve university credits or prior certification at the general medical laboratory level. The bridging programs require prior work experience, with PLA (prior learning assessment) processes in place at the two programs directed at international graduates.

Selection processes consist mainly of first-come first-served strategies, interviews, academic transcripts, and requirements for tours of laboratories. The relationships among entry requirements, selection processes, student retention rates, program curricula, and student outcomes have not been examined in medical laboratory programs in general, although it is possible that institutional research has been conducted but not made available.

TABLES 7A and 7B: Student numbers and class size changes 2003/4
Most programs receive many more student applications ('applications') than the spaces they have available. In cases where the number of reported applications is the same as the number of students accepted into a program ('acceptances'), the institution uses a 'first-come, first served')

entry process and simply stops taking applications when the required number of qualified applicants has been met.

A number of programs report recent modest increases in class sizes. There are others that report a desire to increase class sizes and comment on the constraints imposed by lack of availability of clinical sites in which to train their students.

TABLES 8A and 8B: Program retention rates, didactic curriculum models, and criteria for moving from didactic to clinical phase

The percentages of students who persist in a program (‘retention’) is the topic of much discussion, as some programs have been dismayed at the large numbers of students they lose, particularly in the first year of the program. (It is worth noting here that, of program directors who reported retention rates for multiple years of their program, rates are lowest for initial program years and improve dramatically for later stages of the programs.) This topic is deserving of further research, particularly now that the data on retention has gone beyond the largely anecdotal nature of previous discussions in the medical laboratory profession.

Traditional curriculum formats with lectures and laboratories predominate as didactic curriculum models (‘curriculum model’), although problem-based learning (‘PBL’) and competency -based techniques were also reported. Other strategies include online and distance learning, self-directed and modular learning, and peer learning through presentations and projects. Medical laboratory curricula in Canadian programs have received little attention; this data represents an important start to gaining an appreciation of the ways that medical laboratory technologists learn.

Successful completion of didactic courses, with a pass mark of 60%, appears to be a common criterion for student entry into the clinical phase. A number of programs reported what is known as a ‘double threshold’ in which students are required to achieve a minimum given mark (commonly 60%) in *both* theory and practical examinations. For example, a student with chemistry marks of 55% in theory and 65% in practical tests would not be permitted to pass the course even though the overall chemistry course mark might have an average of 60%. Many programs insist that students demonstrate this dual proficiency to ensure that those who proceed to the clinical placement phase display minimal levels of achievement in both theoretical and practical skills. The double threshold is an interesting academic criterion that says a great deal about the values of medical laboratory programs. Additional criteria mentioned by some programs include First Aid and CPR programs, immunization prior to entering the clinical site, practical or comprehensive examinations, other courses, or evaluation of criminal records and security clearance.

THE COSTS & BENEFITS OF CLINICAL PLACEMENTS: Preliminary Observations

The object of this larger study, encompassing both Phases 1 and 2, is to create a means of defining and arriving at the costs and benefits of clinical placements. The Canadian studies that have looked at this issue have been local in nature and therefore limited to the contexts within which the programs studied operate. They will be examined in further detail in the Phase 2 report. For the purposes of this first phase of the study, it was necessary only to attempt to define the items that comprise a consideration of costs and benefits in these educational circumstances in order to address them more fully in Phase 2. To this end, the program directors who participated in this survey were asked to call upon their experience to list the costs and benefits of clinical placements. In addition, they were asked to comment on a table that outlined the costs and benefits of clinical education as they have been discussed in the academic literature (see Figure 2).

	Tangible	**Intangible**
COSTS	Staff time Educational materials Space and facilities Accreditation Liability, malpractice insurance Student-performed procedures Student waste Equipment repair Student costs: stipends, meals, parking, graduation, room & board, telephones	Stress Frustration Loss of esteem Responsibility burden Loss of instructor productivity Decreased staff efficiency

	Tangible	**Intangible**
BENEFITS	Student recruitment opportunities Student contributions to workload Increased instructor productivity Decreased costs for new personnel	Upgrading/PD opportunities for staff Improved staff performance Increased prestige for site Increased staff job satisfaction and morale Increased staff self-esteem Transferable skills of preceptors

Figure 2: The costs and benefits of clinical education as they were presented to program directors who participated in this study.

The individual points from these charts are listed individually below, with synopses of respondents' comments as to the relevance of the points to their experience with clinical placements.

TANGIBLE COSTS

staff time	Respondents recognized that the cost of clinical instructor/coordinator time is the most significant tangible cost associated with clinical education. Also significant (but overlooked in these responses) is the cost of the educational program for the time invested at the didactic site in preparing educational materials and other forms of communication and support for clinical instructional personnel.
educational materials	Respondents appeared to agree that most educational materials (tests, review materials, guidelines, competency documents, records) are provided by the educational institution and not by the clinical site. This perspective overlooks the educational institution as a site of expense for clinical education.
space and facilities	There were only two opinions on the impact of space and facilities on the costs of clinical placements and these were widely divergent. The fact that others did not see the need to comment on this possible expense may arise from a perception that pre-existing clinical sites are used 'as is' in their natural state of operations and that clinical education does not necessitate any modifications or special accommodation.
accreditation	Respondents saw no accreditation costs aside from those covered by educational institutions for program accreditation.
liability, malpractice insurance	These costs are covered by the educational institutions and do not accrue to the clinical sites. Nonetheless, they should be considered as contributing to student education costs during the clinical period.
student-performed procedures	Only one respondent commented on this item, noting that such costs are 'minimal'.
student waste	These costs were seen by respondents to be 'minimal'.
equipment repair	Seen to be a non-issue.
student costs: stipends, meals, parking, graduation, room & board, telephones	Many respondents dismissed these as an issue, although for students, they may be important. No programs reported paying stipends to students and respondents believed that most of the other student costs (meals, room & board) were costs that students would bear regardless of the stage of their education. They were viewed as the costs of education. However, it is possible that for students who are required to travel long distances in order to attend the clinical site to which they are assigned, there may be additional costs of relocation. Several respondents acknowledged graduation costs.

ADDITIONAL RESPONSES	Three respondents quoted dollar figures for clinical education: one noted that the estimated costs of the practicum is approximately $33,000 per student (for 42 weeks); another mentioned the figure $12,000 (for 26 weeks), while another stated that the process costs about $400 per week per student in clinical instructor salary alone. Even where ministry agreements are in place for covering clinical education costs (i.e., in Quebec), these sums are felt to be insufficient to cover all related costs of student education.

INTANGIBLE COSTS

stress	Opinions were divided on the issue of stress. Some felt that clinical placements involve a fair level of stress for laboratory workers, particularly if they must maintain a certain level of productivity while carrying out teaching responsibilities. Others felt that selection of appropriate individuals for instructional duties was key in determining/minimizing stress. Still others suggested that any stress involved with clinical teaching decrease with experience as technologists become more comfortable with sharing their knowledge. Some respondents acknowledge that clinical placement involves stress for the student.
frustration	Again, respondents suggested that this depends on how instructors are selected, and that it may be a function of pressures on teaching technologists to maintain productivity while teaching. One respondent commented on the lack of respect for technologists by students who are overly aggressive/demanding.
loss of esteem	This item was the most vehemently denied by respondents. One respondent suggested that a loss of esteem was conceivable only if technologists are embarrassed by what they don't know.
responsibility burden	One respondent noted that clinical teaching is a burden only when it results in stress and frustration if teaching duties are added on top of work duties. Respondents notes that teaching is not a burden where clinical instructors are released from their bench duties.
loss of instructor productivity	A number of respondents noted that releasing clinical instructors from their bench duties separates instructional duties from pressures related to laboratory productivity, as well as from the stress and frustration noted above by other respondents.
decreased staff efficiency	Although a number of respondents denied that this occurs, others felt that staff efficiency could be adversely affected when students first arrive at the bench. They pointed to the possibility delayed patient reports, and felt that such effects were inevitable in laboratory environments where human resources are stretched to the limit.

ADDITIONAL RESPONSES	Clinical instructors are busy, and are not all suited to teaching. Students must ‘sink or swim’ if they are assigned to an instructor who cannot meet their needs, either because of teaching style or due to lack of instructor time.

TANGIBLE BENEFITS

Student recruitment opportunities	Clinical training permits employers to assess potential employees and to recruit promising candidates before they enter the job market. Students are often quite willing to work in laboratories with which they are already familiar.
student contributions to workload	Respondents agreed that students are not expected to replace a technologist. While it is possible that a student might carry out certain tasks at the end of a placement phase, for the most part, the student is expected to be supervised and does not make independent contributions to laboratory workload.
increased instructor productivity	Respondents did not see this occurring in terms of laboratory workload, but one respondent suggested that clinical training facilitated an instructor’s assessment of student competency (and hence, his/her productivity as an educators) by enabling evaluation in a real-life authentic environment.
decreased costs for new personnel	Respondents agreed that hiring students trained at the site reduces the orientation time for new employees as they are already familiar with the workplace. Fewer hiring interviews are required and employers benefit from the clearer choices that advanced knowledge of students affords them..
ADDITIONAL RESPONSES	Clinical education enhances the marketability of graduates of medical laboratory programs and may serve as a means for securing employment.

INTANGIBLE BENEFITS

upgrading/PD opportunities for staff	Clinical education offers staff at the clinical site opportunities to upgrade their skills and obtain additional professional development.
improved staff performance	Respondents saw a definite connection between clinical education and increased staff knowledge and skills (teaching, evaluation, etc.) when staff – including those who do not have direct teaching responsibilities – are challenged to remain up to date.
increased prestige for site	Teaching is considered to be part of the mission of hospital-universities.
increased staff job satisfaction and morale	Respondents suggested that clinical teaching can be a satisfying and rewarding experience for technologists.
increased staff self-esteem	As above
transferable skills of preceptors	The skills that clinical instructors gain from their teaching experience can be applied to other situations.

ADDITIONAL RESPONSES	Many of the additional comments noted here related to the benefits of clinical education for students. The clinical experience was thought to offer students invaluable and irreplaceable opportunities to: • gain real-life hands-on experience in contexts that cannot be simulated at an educational institution; • connect theory with practice; • work with real patients and coworkers in a health care setting; • prepare for autonomous practice; • acquire an appreciation of the 'grey areas' of laboratory practice and the need for judgement and decision making; • pick up 'tricks of the trade' and troubleshooting strategies from experts in the field; • gain speed, precision, and a growing ability to multi-task; • acquire better insight into the nature of laboratory work; • facilitate the transition from student to employee; • gain exposure to other experiences available in a health care institution, such as rounds, presentations, or autopsies; • work with a broader spectrum of personalities and workplace demands. In addition, clinical placement serves as an important opportunity for internationally-trained MLTs to gain knowledge of the Canadian health care environment, offering them greater employment opportunities and a greater chance of success on CSMLS examinations. It is reasonable to expect that any experience that results in enhanced learning (and/or greater level of competence) for the medical laboratory student could have implications for enhanced contribution to the quality of laboratory and health care services. Furthermore, the real-life experience afforded by clinical placements is an important recruiting feature of educational programs and may enhance their credibility in the eyes of potential students. Employers play a crucial role in maintaining the workforce. It is not unreasonable to expect that they should contribute to educating the workforce from which they ultimately benefit.

What became apparent during this process is that many of the discussions about the costs of clinical placements, both in the literature and elsewhere, focus on the costs to the clinical sites, failing to consider costs to other individuals or the numerous benefits to many of the stakeholders. As a result of the feedback from respondents to this survey, the outline of costs and benefits that will guide the Phase 2 study has been modified as follows:

	Tangible	Intangible
C O S T S	CLINICAL SITE • staff time • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time; scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • graduation	CLINICAL SITE • decreased staff efficiency & productivity CLINICAL INSTRUCTORS • stress & frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction

	Tangible	Intangible
B E N E F I T S	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in authentic environment • correlation of theory with practice • working with patients & skilled role models • opportunity to hone skills, speed, judgment • appreciation of 'grey areas' of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

This interim list of costs and benefits remains to be validated by laboratory directors, clinical instructors and students in Phase 2.

PLANNING FOR PHASE 2

Criteria for Identifying Models of Clinical Placements

The criteria that appear to differentiate the models for clinical placements in medical laboratory programs include the length of clinical placements, the timing of placements, use of simulations, compensation mechanisms to clinical sites, and the degree of integration of didactic and clinical experience. Keeping in mind that the size and diversity of the programs being studied result in some overlapping of categories, the following set of five program models is proposed:

MODEL A
The Cegep medical laboratory programs are credible as a single model because of their relative overall uniformity, their mid-range length of clinical placement phases, and the existence of an agreement between the Ministries of Health and Education regarding compensation for clinical education. This agreement, and any studies conducted to inform it, are worthwhile objects for further inquiry.

MODEL B
The medical laboratory programs at the College of the North Atlantic and New Brunswick Community College both use simulations in their didactic programs and report clinical placement periods that are significantly shorter than those of other programs. In light of current interest among allied health professions in simulated clinical education, these strategies merit further investigation as they have been applied to existing laboratory programs. The ambiguous use of the term ‘simulation’ by some respondents, as discussed earlier in this report, demands further clarification before any other programs can be considered in this model.

MODEL C
The use of staggered periods of clinical education differs from what appears to be a professional norm involving placement of the clinical phase at the end of the didactic phase. The rationale for and implications of this programmatic structure should be looked into. This model encompasses the medical laboratory programs at the University of Alberta, BCIT, the Michener Institute, and SIAST; the cytotechnology programs at BCCA, QEII/Dalhousie; and the bridging program at Mohawk.

MODEL D
A number of the diploma programs are linked to or are explicit parts of a degree program. These include general medical laboratory programs at Red River, CCNB-Campbellton, and St. Clair. What impact do university affiliations and the constraints of university curricula have on the implementation of clinical education? This is a valuable avenue of inquiry as diploma programs increasingly investigate the potential for collaborative college-university programs.

MODEL E
A number of programs fit into what might be referred to as a ‘traditional’ model for medical laboratory education: the lengths of their clinical programs are similarly long, they place their clinical education at the end of the didactic phase, and they do not use simulations. This model includes general programs at St. Clair College, St. Lawrence College; cytotechnology programs at NAIT and SIAST; and possibly the two clinical genetics programs, although they are sufficiently different from each other to prompt questions about their assignment to the same category.

Finally, while it would also prove fascinating to study the one program that still makes use of a fully-integrated clinical apprenticeship-like model (Regina HDSC), this program is being discontinued, thus mitigating against further study of its format or generalization of its strategies to other institutions.

Next Steps

The identification of costs and benefits, discussed earlier, and the creation of five models of clinical placements, create the foundational information needed to proceed with the next phase of this study: further investigation of clinical placements as they are implemented at clinical sites.

As outlined in the original proposal for this study, five sites (presumably, one from each of the five models) will be contacted and asked to participate in written surveys. If they grant permission, surveys will be sent to the laboratory director, (a) clinical instructor(s), and (a) student(s) as available at the site. The surveys will follow the formats outlined in the project proposal, with modifications to the questions arising from the findings of Phase 1. A further five sites (again, one from each of the five models) will be contacted and asked to participate in on-site research: with the necessary permission in place, the principal investigator of this study will visit the sites and conduct interviews with the laboratory director, clinical instructors, and students, as well as observing the clinical instruction process over a limited period of time. The interviews will follow the format outlined in the original study proposal, with modifications as suggested by Phase 1. In both avenues of inquiry (written surveys and on-site studies), attention will be focused on data that will contribute to the study’s goal of identifying the costs and benefits of, and potential alternatives to, clinical placements for medical laboratory students.

SUMMARY

The constraints involved in collecting and organizing a considerable quantity of data from a large number of sources in a relatively brief time span have necessitated a somewhat superficial and brief analysis and discussion process. The data could benefit from a sustained examination of the relationships among and implications of some of the findings. Many areas for further inquiry have been noted in the discussions. It is expected that Phase 2 of the study will offer a much-needed opportunity to fill in the informational gaps and to examine the data more fully.

For now, it suffices to acknowledge that the data collected to date constitute a considerable addition to what is known about Canadian medical laboratory educational programs. Phase 1 has permitted an elaboration and refinement of a list of costs and benefits that will prove useful for Phase 2 of the study, and has resulted in the creation of a system for viewing the various programs in terms of their ‘fit’ into five models for clinical education practices. These models suggest the direction to be taken in the second phase of this research project.

APPENDIX A
PROGRAM DATA TABLES

DATA ON CLINICAL PLACEMENTS

TABLE 1A	Overall Program Details for Clinical Placements: General medical laboratory programs
TABLE 1B	Overall Program Details for Clinical Placements: Cytotechnology, Clinical Genetics and Bridging Programs
TABLE 2A	Clinical education program implementation: General medical laboratory programs
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TABLE 3A	Teaching personnel in the clinical setting: General medical laboratory programs
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TABLE 4A	Rotation lengths (in weeks) through subject areas: General medical laboratory programs
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TABLE 5A	Financial remuneration mechanisms: General medical laboratory programs
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DATA ON DIDACTIC PROGRAMS

TABLE 6A	Program entry requirements and selection processes: General medical laboratory programs
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TABLE 7A	Student numbers and class size changes 2003/4: General medical laboratory programs
TABLE 7B	Student numbers and class size changes 2003/4: Cytotechnology, Clinical Genetics and Bridging Programs
TABLE 8A	Program retention rates, didactic curriculum models, and criteria for moving from didactic to clinical phase: General Laboratory Programs
TABLE 8B	Program retention rates, didactic curriculum models, and criteria for moving from didactic to clinical phase: Cytotechnology, Clinical Genetics and Bridging Programs

NOTE: NA = Data not available

TABLE 1A: Overall Program Details for Clinical Placements
GENERAL MEDICAL LABORATORY PROGRAMS

PROGRAM	TOTAL PROGRAM WEEKS	CLINICAL WEEKS	PLACES	STUDENTS	SITES	MULTIPLE SITES
NAIT	81	42	32	17	3	Yes
U of Alberta	120	42	16	17	NA	Yes
BCIT	87	40	39	49	11	No
Red River	88	44	30	22	3	Yes
CCNB-Campbellton	75	28	6	5	1	No
NBCC	89	12	20	18	9	Yes
CNA	107	15	29	30	8	No
Cambrian	NA	NA	NA	NA	NA	NA
Michener	105	45	36	22	15	some sites
St. Clair	102	35	29	24	8	No
St. Lawrence	110	45	45	35	20	Yes
Chicoutimi	101	26	NA	NA	NA	NA
Dawson	101	26	21	21	6	some sites
Rimouski	NA	NA	NA	NA	NA	NA
Rosemont	96	26	35	28	9	Yes
Saint-Hyacinthe	96	26	30	14	5	Yes
Saint-Jean	96	26	30	30	4	Yes
Saint-Jerome	NA	26	30	23	NA	NA
Sainte-Foy	96	26	54	51	8	Yes
Shawinigan	106	26	15	10	3	No
Sherbrooke	NA	26	24	24	3	Yes
SIAST	80	40	32	16	12	Yes

TABLE 1B: General program details for clinical placements CYTOTECHNOLOGY, CLINICAL GENETICS, and BRIDGING PROGRAMS

Cytotechnology

PROGRAM	TOTAL PROGRAM WEEKS	CLINICAL WEEKS	PLACES	STUDENTS	SITES	MULTIPLE SITES
NAIT	88	49	11	11	5	Yes
BCCA	90	18	5	4	5	Yes
Winnipeg HSC	46	28	30	NA	1	No
QEII/Dal	117	39	30	19	16	Yes
Michener	68	42	24	24	20	Yes
Hotel Dieu	NA	9	NA	3	NA	NA
Rosemont	NA	NA	NA	NA	NA	NA
Regina HDSC	95	50	0	3	50	Yes
SIAST	88	45	4	0	45	Yes

Clinical genetics

PROGRAM	TOTAL PROGRAM WEEKS	CLINICAL WEEKS	PLACES	STUDENTS	SITES	MULTIPLE SITES
BCIT	43	18	8	8	8	Yes
Michener	57	36	17	14	15	Yes

Bridging programs

PROGRAM	TOTAL PROGRAM WEEKS	CLINICAL WEEKS	PLACES	STUDENTS	SITES	MULTIPLE SITES
SAIT	68	36	21	18	4	varies
Michener	variable	varies	20	19	11	varies
Mohawk	39	18	18	17	5	Yes

TABLE 2A: Clinical education program implementation
GENERAL MEDICAL LABORATORY PROGRAMS

PROGRAM	TIMING	SIMULATED LABS	ADDITIONAL STUDENT ACTIVITIES
NAIT	end of didactic	some	none
U of Alberta	staggered	yes	additional courses
BCIT	staggered	no	field trips, other
Red River	end of didactic	yes	rounds, conferences
CCNB-Campbellton	end of didactic	no	as available at the site
NBCC	staggered	yes	field trips, seminars
CNA	end of didactic	yes	field trips
Cambrian	NA	NA	NA
Michener	staggered	no	as available at the site
St. Clair	end of didactic	NA	as available at the site
St. Lawrence	end of didactic	no	rounds, seminars, as available at site
Chicoutimi	end of didactic	some	none
Dawson	end of didactic	no	field trips, rounds, seminars
Rimouski	NA	NA	NA
Rosemont	end of didactic	no	conferences
Saint-Hyacinthe	end of didactic	NA	none
Saint-Jean	end of didactic	no	conferences
Saint-Jerome	end of didactic	NA	none
Sainte-Foy	end of didactic	yes	conferences, seminars, as available at site
Shawinigan	end of didactic	NA	other activities
Sherbrooke	other	no	attending autopsies
SIAST	staggered	no	none

TABLE 2B: Clinical education program implementation

CYTOTECHNOLOGY, CLINICAL GENETICS, AND BRIDGING PROGRAMS

Cytotechnology

PROGRAM	TIMING	SIMULATED LABS	ADDITIONAL STUDENT ACTIVITIES
NAIT	end of didactic	varies	none
BCCA	staggered	NA	none
Winnipeg HSC	NA	no	conferences, other activities
QEII/Dal	staggered	no	none
Michener	end of didactic	yes	other activities
Hotel Dieu	end of didactic	no	conferences
Rosemont	NA	NA	NA
Regina HDSC	fully integrated	no	other activities
SIAST	end of didactic	no	other activities

Clinical genetics

PROGRAM	TIMING	SIMULATED LABS	ADDITIONAL STUDENT ACTIVITIES
BCIT	end of didactic	yes	other activities
Michener	end of didactic	NA	rounds, journal clubs

Bridging programs

PROGRAM	TIMING	SIMULATED LABS	ADDITIONAL STUDENT ACTIVITIES
SAIT	end of didactic	no	rounds, presentations, seminars as available
Michener	NA	no	none
Mohawk	staggered	no	field trips

TABLE 3A: Teaching personnel in the clinical setting
GENERAL MEDICAL LABORATORY PROGRAMS

PROGRAM	INSTRUCTOR TITLE	AFFILIATION	GUIDANCE PROVIDED	RESOURCES/SUPPORT
NAIT	varies from site to site	clinical site employee	Varies: two clinical site models in use	learning materials
U of Alberta	clinical instructors	shared didactic/clinical responsibilities	at-the-bench techs, lectures, review sessions, tests	release from benchwork
BCIT	bench technologists & clinical instructors	clinical site employee	at-the-bench supervision, some review sessions, some tests	none reported
Red River	preceptors & clinical evaluators	clinical site employee	at-the-bench supervision, review sessions, tests, competency testing	none reported
CCNB-Campbellton	technologiste en charge	clinical site employee	direct on-site supervision, theoretical teaching, review and tests	teaching support
NBCC	clinical instructor	clinical site employee	at-the-bench supervision	none reported
CNA	liaison technologist	hospital employee	on-site visits, review sessions, tests	none reported
Cambrian	NA	NA	NA	NA
Michener	clinical instructor	clinical site employee	at-the-bench supervision, lectures, review sessions, tests, quizzes	teaching courses & materials, educational documents; professional development funds
St. Clair	site instructor	clinical site employee	at-the-bench supervision, lectures, review sessions, tests, sample preparation	none reported
St. Lawrence	teaching technologist	clinical site employee	tests	none reported
Chicoutimi	instructeur/moniteur clinique	clinical site employee	on-site supervision, theory sessions, tests	none reported
Dawson	teaching technologist or clinical instructor	clinical site employee	at-the-bench supervision	none reported
Rimouski	NA	NA	NA	NA
Rosemont	instructeur clinique	clinical site employee	direct on-site supervision	differs from one site to another
Saint-Hyacinthe	moniteur clinique	clinical site employee	direct on-site supervision, review sessions, practical exams	yes
Saint-Jean	moniteurs de stage & instituteur clinique	clinical site employee	direct on-site supervision, practical exams	release from bench duties
Saint-Jerome	moniteur	clinical site employee	on-site supervision	full release from bench duties
Sainte-Foy	instituteurs clinique & superviseur	clinical site employee	direct on-site supervision, some tests	approximately $48/week for the main clinical instructor
Shawinigan	coordonnateur de stage & superviseur	clinical site employee	on-site supervision, review sessions, tests	technician/monitor salary
Sherbrooke	moniteur clinique	clinical site employee	direct supervision with theoretical reviews	none reported
SIAST	mentor	clinical site employee but also serve as college instructors	at-the-bench supervision, review sessions, tests, tutorials, remedical programs, competency testing; 'travel' with students	program orientation, mentor manual, review/overview of competencies; SSMLT credits for professional activity

TABLE 3B: Teaching personnel in the clinical setting
CYTOTECHNOLOGY, CLINICAL GENETICS, AND BRIDGING PROGRAMS

Cytotechnology

PROGRAM	INSTRUCTOR TITLE	AFFILIATION	GUIDANCE PROVIDED	RESOURCES/SUPPORT
NAIT	varies from site to site	clinical site employee	tests	access to learning materials
BCCA	teaching technologist	clinical site employee	at-the-bench supervision, review sessions, tests	none reported
Winnipeg HSC	clinical instructor & teaching technologists	one instructor for entire program	at-the-bench supervision, review sessions, tests	none reported
QEII/Dal	preceptors	clinical site employee	at-the-bench supervision, review sessions	preceptor workshops
Michener	clinical coordinators & clinical instructors	clinical site employee	at-the-bench supervision, review sessions, quizzes, tests	none reported
Hotel Dieu	instituteur clinique	clinical site employee	at-the-bench supervision	none reported
Rosemont	NA	NA	NA	NA
Regina HDSC	clinical instructors	clinical site employee	at-the-bench supervision, lectures, review sessions, tests	none reported
SIAST	mentors	clinical site employee	at-the-bench supervision, lectures, review sessions, tests	program orientation, manual, competency documents

Clinical genetics

PROGRAM	INSTRUCTOR TITLE	AFFILIATION	GUIDANCE PROVIDED	RESOURCES/SUPPORT
BCIT	student supervisor	clinical site employee	at-the-bench supervision, reviews	teaching workshops
Michener	clinical coordinator & teaching technologist	clinical site employee	at-the-bench supervision, review sessions	teaching workshop, liaison support, $500 for professional development

Bridging programs

PROGRAM	INSTRUCTOR TITLE	AFFILIATION	GUIDANCE PROVIDED	RESOURCES/SUPPORT
SAIT	preceptors & clinical instructors	clinical site employee	tests	learning/testing materials, texts, modules, training, recognition event
Michener	clinical instructors/ teaching technologists	clinical site employee	at-the-bench supervision, review sessions, tests/quizzes	continuing education credits
Mohawk	teaching technologists	clinical site employee and some didactic	at-the-bench supervision, review sessions, tests	access to clinical guidelines

TABLE 4A: Rotation lengths (in weeks) through subject areas
MEDICAL LABORATORY GENERAL PROGRAMS

PROGRAM	CHEM	HEM	MICRO	TM	HISTO	OTHER
NAIT	10	10	10	5	5	blood collection & accessioning: 2
U of Alberta	10	10	10	5	5	phlebotomy 2
BCIT	11	10	10	6	5	phlebotomy & accessioning 2
Red River	8	11	11	5	6	phlebotomy 3
CCNB-Campbellton	6	6	8	3	3	phlebotomy 45 hr.
NBCC	2.5	2	2.5	1.5	1.5	phlebotomy 1; urinalysis 1
CNA	3	3	3	3	3	none
Cambrian	NA	NA	NA	NA	NA	NA
Michener	9	9	10	7	7	orientation 1; discretionary 2
St. Clair	8	6	8	6	4	clinical work experience 3
St. Lawrence	9	9	10	9	10	none
Chicoutimi	7	5	7	4	3	none
Dawson	7	4	7	4	3	none
Rimouski	NA	NA	NA	NA	NA	NA
Rosemont	6	5	7	4	3	phlebotomy 1
Saint-Hyacinthe	6	4	6	3	3	phlebotomy 1; 'integration' 4
Saint-Jean	5	4	5	4	3	phlebotomy 1; molecular genetics 4
Saint-Jerome	7	5	7	4	3	none
Sainte-Foy	7	5	7	4	3	(hematology includes phlebotomy)
Shawinigan	6	5	7	4	4	none
Sherbrooke	6	5	6	4	3	phlebotomy 1; observation 15 hr.
SIAST	8	8	9	5	4	clinical introduction 6

TABLE 4B: Rotation lengths (in weeks) through subject areas
CYTOTECHNOLOGY, CLINICAL GENETICS, AND BRIDGING PROGRAMS

Cytotechnology

PROGRAM	PREP	OTHER
NAIT	3	screening 46
BCCA	1	screening 2; hospital sites 13
Winnipeg HSC	-	total 28
QEII/Dal	-	total 39
Michener	-	gyn 12; gyn & non-gyn 30
Hotel Dieu	-	total 9 weeks
Rosemont	NA	NA
Regina HDSC	3	FNA 2; gyn prep 2; other 43
SIAST	-	total 45

Clinical genetics

PROGRAM	Molecular genetics	Cytogenetics/FSH
BCIT	12	18
Michener	18	18

Bridging

PROGRAM	CHEM	HEM	MICRO	TM	HISTO/OTHER
SAIT	8	8	9	5	5
Michener	adjusted to suit the needs of the client				
Mohawk	6	3	4	3	2

TABLE 5A: Financial remuneration mechanisms
GENERAL MEDICAL LABORATORY PROGRAMS

PROGRAM	INSTRUCTOR REMUNERATION	CLINICAL SITE REMUNERATION	TUITION
NAIT	NA	none	$3035/yr
U of Alberta	none	none	~$4300/yr
BCIT	from level 1 to level 2 pay	none	$2040/yr
Red River	none	2 hr/day/discipline/site paid to central authority for distribution	$2600/yr
CCNB-Campbellton	none	none	~$4200/yr
NBCC	none	$350/week/student paid to hospitals; not to newer sites	$60/wk
CNA	none	none	$2600/yr
Cambrian	NA	NA	NA
Michener	PD credits	$160/student/week paid to site in addition to $500/yr toward PD activities	annual tuition
St. Clair	none	yes - paid by St. Clair college to clinical sites	$2500/yr
St. Lawrence	none	flat fee per student paid to hospital	$3500/yr
Chicoutimi	yes	NA	$185/yr
Dawson	yes	as per inter-ministry agreement	$106/yr
Rimouski	NA	NA	NA
Rosemont	NA	NA	none
Saint-Hyacinthe	NA	NA	NA
Saint-Jean	none	none	none
Saint-Jerome	NA	none	annual tuition
Sainte-Foy	$48/wk for main instructor	as per inter-ministry agreement	$286/yr
Shawinigan	salary for clinical monitor	NA	NA
Sherbrooke	yes	as per inter-ministry agreement	$110/yr
SIAST	none	none	$3520/yr

TABLE 5B: Financial remuneration mechanisms
CYTOTECHNOLOGY, CLINICAL GENETICS and BRIDGING PROGRAMS

Cytotechnology

PROGRAM	INSTRUCTOR REMUNERATION	CLINICAL SITE REMUNERATION	TUITION
NAIT	none	none	$3034.96/yr
BCCA	none	one site bills yearly	$2000/yr
Winnipeg HSC	none	none	no tuition
QEII/Dal	none	none	$680/yr
Michener	$500 in PD funds	$160/student/week	$5271/program
Hotel Dieu	yes	none	none
Rosemont	NA	NA	NA
Regina HDSC	NA	NA	no tuition
SIAST	none	none	$4300/yr

Clinical genetics

PROGRAM	INSTRUCTOR REMUNERATION	CLINICAL SITE REMUNERATION	TUITION
BCIT	none	none	no tuition
Michener	$500 in PD funds	$160/student/week plus $7.50/student/ week in credits for PD courses	$5937/program

Bridging programs

PROGRAM	INSTRUCTOR REMUNERATION	CLINICAL SITE REMUNERATION	TUITION
SAIT	none	none	$2800/yr
Michener	funds for PD courses	$160/student/week and $8.50/student/week in credits for PD courses	$200/week
Mohawk	none	$160/student/week	$160/week

TABLE 6A: Program entry requirements and selection processes
GENERAL MEDICAL LABORATORY PROGRAMS

PROGRAM	ENTRY REQUIREMENTS	SELECTION PROCESS
NAIT	high school diploma; English, Math chem, Biology; 60% minimum	interviews; lab tour required; career investigation
U of Alberta	1 year university level courses; minimum 60%	grades (cumulative GPA); letter of intent; lab tour
BCIT	Gr 12 biology, chem, math, English; Gr11 physics; C+ minimum	marks, letter of intent, resume, volunteer work, lab visit
Red River	24 credits at university level: chemistry, biology, and others	first come, first served; CPR; immunization
CCNB-Campbellton	one year of health studies at the Universite de Moncton	interviews, academic transcripts; lab tour recommended
NBCC	Gr 11/12 physics & chem; Gr12 biology, math & English	marks most important; related experience; hospital visit
CNA	60% in Gr12 English and Math; 4 other science credits	first come first served to common first year of program
Cambrian	NA	NA
Michener	Gr13 math, English, chem, biol or physics	first come first served, application service screening, lab visit
St. Clair	Gr12 English, math; one of senior chem/biol/phys; minimum 60%	application service, meet minimum requirements
St. Lawrence	Gr 12 English, math; Gr 11 chemistry; Gr 11 biology or math	academic ranking; lab visit recommended
Chicoutimi	high school diploma with sciences and math	academic results
Dawson	high school diploma; math chemistry, physics	interviews
Rimouski	NA	NA
Rosemont	NA	transcripts, interviews as needed
Saint-Hyacinthe	high school diploma with chemistry, physics, math	first come, first served; no quota
Saint-Jean	high school diploma: math, chemistry, physics; 60% minimum	ranking through application service, some interviews
Saint-Jerome	NA	first come, first served
Sainte-Foy	high school diploma: math, physics, chemistry	academic excellence
Shawinigan	high school diploma; math, physics, chemistry , biology	first come, first served
Sherbrooke	high school diploma: math, physics, chemistry	first come, first served
SIAST	Gr12 English, Math, two of Physics, Chem, Biology; 70% minimum	first come, first served; meeting with director; job shadowing

TABLE 6B: Program entry requirements and selection processes
CYTOTECHNOLOGY, CLINICAL GENETICS AND BRIDGING PROGRAMS

Cytotechnology

PROGRAM	ENTRY REQUIREMENTS	SELECTION PROCESS
NAIT	high school diploma; English, Math chem, Biology; 60% minimum	interviews, lab tour required; career investigation
BCCA	1 year university: math, biology, English and one other science	interviews, presentations by applicant
Winnipeg HSC	general medical laboratory certification or BSc	interviews
QEII/Dal	Gr12 math, English, chem, biol, one other science; min 70%, 75% overall	academic standing; autobiographical letter
Michener	general medical laboratory certification or BSc in anatomy & physiology	ranking through interviews; references; lab tour; experience
Hotel Dieu	general medical laboratory certification	transcripts or interviews
Rosemont	NA	NA
Regina HDSC	general medical laboratory certification	interviews
SIAST	Gr12 English, Math, physics, chem, biology, minimum 70%	first come, first served; First Aid & CPR

Clinical genetics

PROGRAM	ENTRY REQUIREMENTS	SELECTION PROCESS
BCIT	BSc in cell biology (genetics/cytogenetics/molecular genetics)	multiple interviews, application screening, work experience
Michener	BSc or general medical laboratory certification + university genetics credit	interviews

Bridging programs

PROGRAM	ENTRY REQUIREMENTS	SELECTION PROCESS
SAIT	prior assistant/technician training at SAIT or NAIT; min. 60%	interviews; English proficiency testing, work experience
Michener	PLA equivalence; citizen/landed immigrant; regulatory body membership	English proficiency testing; professional assessment
Mohawk	international laboratory certification; equivalence through PLA	interviews, language testing; prior work experience

TABLE 7A: Student numbers and class size changes 2003/4
GENERAL MEDICAL LABORATORY PROGRAMS

PROGRAM	APPLICATIONS	ACCEPTANCES	CHANGES IN CLASS SIZE: RECENT OR ANTICIPATED
NAIT	147	32	increased from 17 in 2000 to 32; no plans to increase unless more clinical sites are found
U of Alberta	160	18	our quota is 26 but we have only 18 due to clinical placement restraints
BCIT	150	44	Ministry has requested that we take 60 per year rather than 40
Red River	68	29	standard class size is 25; more were accepted in 2003 to address workplace needs
CCNB-Campbellton	16	6	we have always had 6 places; will be increasing to 9 places in the fall of 2005
NBCC	90	22	none
CNA	400	29	no changes but see greater interest and full enrollment in past 2 years
Cambrian	NA	NA	NA
Michener	600+	64	increased in response to workplace needs: from 29 (2000) to 64 (2003)
St. Clair	328	48	maximum in diploma program raised from 36 to 48 in last 5 years
St. Lawrence	309	50	increase from 40 to 50 four years ago; no plans to change due to placement restrictions
Chicoutimi	90	25	the numbers are constant
Dawson	85	35	there has been a slight increase; no plans to change in the near future
Rimouski	NA	NA	NA
Rosemont	78	55	we hope to increase class sizes
Saint-Hyacinthe	22	22	none
Saint-Jean	52	36	increase of 30% in past 5 years; small increases possible
Saint-Jerome	48	40	a constant 40 to 45 per year
Sainte-Foy	99	53	have always had 60 places; studying impact of increases
Shawinigan	30	30	none
Sherbrooke	30	30	none
SIAST	155	16	no changes in past 6 years; no changes planned

TABLE 7B: Student numbers and changes in class sizes 2003-4
CYTOTECHNOLOGY, CLINICAL GENETICS AND BRIDGING PROGRAMS

Cytotechnology

PROGRAM	APPLICATIONS	ACCEPTANCES	CHANGES IN CLASS SIZE: RECENT OR ANTICIPATED
NAIT	39	11	increased from 6 (1999) to 11 (2003); no plans to increase unless more clinical sites are found
BCCA	50	4	none
Winnipeg HSC	3	2	class size averages 2 to 3 students
QEII/Dal	40	10	increased by 25% with no plans to increase further
Michener	187	23	increased from 9 (1999) to 23 (2003); plan to reduce to 19 in 2004
Hotel Dieu	7+	7	we can accommodate a maximum of 9; no plans to increase class size
Rosemont	NA	NA	NA
Regina HDSC	NA	NA	increased from 2 to 4 students
SIAST	4	4	new program

Clinical genetics

PROGRAM	APPLICATIONS	ACCEPTANCES	CHANGES IN CLASS SIZE: RECENT OR ANTICIPATED
BCIT	65	8	class size is 7-9 per year
Michener	188	17	increased from 8 to 17; clinical placement sites and size of our labs limit class size

Bridging programs

PROGRAM	APPLICATIONS	ACCEPTANCES	CHANGES IN CLASS SIZE: RECENT OR ANTICIPATED
SAIT	57	21	limited in past due to clinical placement constraints and to low numbers of qualified students
Michener	varies	varies	non-traditional program structure; clients register on a course-by-course basis
Mohawk	89	20	new program

TABLE 8A: Program retention rates, didactic curriculum models, and criteria for moving from didactic to clinical phase
GENERAL LABORATORY PROGRAMS

PROGRAM	RETENTION	CURRICULUM MODEL	PASS CRITERIA FOR ENTRY INTO CLINICAL PLACEMENT PHASE
NAIT	100%	traditional & PBL	successful completion of didactic courses (60%); First Aid, CPR, immunizations
U of Alberta	95-100%	traditional lecture/lab	passing technical grade, 60% pass mark on all courses, (C-) overall average
BCIT	80%	traditional, PBL & other	double threshold pass (60%); practical assessments; immunization, criminal record search
Red River	75% (year 1)	traditional lecture/lab	all didactic courses must be passed with a double threshold 60% pass mark
CCNB-Campb.	83%	traditional lecture/lab	successful completion of all program courses: double threshold 60%
NBCC	40-82%	traditional lecture/lab	pass all prerequisite courses (60%); First Aid & CPR
CNA	40% (year 1)	traditional lecture/lab	pass all first year (50%) and second year (60%) courses, First Aid & CPR
Cambrian	NA	NA	NA
Michener	60%	traditional, PBL & other	double threshold (60%) on all didactic courses
St. Clair	52% (year 1)	traditional, PBL, competency	successful completion of theory courses (65%) and lab courses (75-80%)
St. Lawrence	60%	traditional lecture/lab	minimum 65% in second year courses; satisfactory lab performance
Chicoutimi	85%	traditional & competency	successful completion of theoretical courses with 60% pass mark
Dawson	57%	traditional & competency	successful completion of first five semesters with 60%, comprehensive assessment
Rimouski	NA	NA	NA
Rosemont	60%	traditional, PBL, core lab	successful completion of final didactic session with 60% pass mark
Saint-Hyacinthe	NA	traditional & case study	successful completion of courses with 60% pass mark
Saint-Jean	60-70%	traditional lecture/lab	successful completion of final didactic session with 60% pass mark
Saint-Jerome	55-75%	traditional lecture/lab	successful completion of rest of program with 60% pass mark
Sainte-Foy	74%	traditional lecture/lab	successful completion of all courses; double threshold 60%
Shawinigan	50%	traditional & PBL	successful completion of all courses with 60% pass mark
Sherbrooke	70%	traditional & PBL	pass all courses with 60% pass mark
SIAST	88%	traditional lecture/lab	successful completion of courses with minimum 60%; CPR/First Aid

TABLE 8B: Program retention rates, didactic curriculum models, and criteria for moving from didactic to clinical phase
CYTOTECHNOLOGY, CLINICAL GENETICS AND BRIDGING PROGRAMS

Cytotechnology

PROGRAM	RETENTION	CURRICULUM MODEL	PASS CRITERIA FOR ENTRY INTO CLINICAL PLACEMENT PHASE
NAIT	100%	traditional & PBL	successful completion of didactic phase (60%); First Aid, CPR; immunization
BCCA	100%	traditional lecture/lab	pass all courses: first year pass mark 65%; second year 75%; CPR; distance course
Winnipeg HSC	66-100%	traditional lecture/lab	65% pass mark; completion of correspondence course on instrumentation
QEII/Dal	80-85%	traditional, PBL, modules	meet all discipline prerequisites; pass mark 65%; basic life support, First Aid
Michener	95%	PBL, distance, self-directed	successful completion of all written and practical components (60% pass mark)
Hotel Dieu	90-100%	integrated theory & practice	all aspects of the courses must be passed (60% pass mark) before advancing
Rosemont	NA	NA	NA
Regina HDSC	75-100%	traditional lecture/lab	65% pass mark; CPR, First Aid
SIAST	100%	traditional lecture/lab	successful completion of all courses (minimum 60%)

Clinical genetics

PROGRAM	RETENTION	CURRICULUM MODEL	PASS CRITERIA FOR ENTRY INTO CLINICAL PLACEMENT PHASE
BCIT	almost 100%	traditional & PBL	pass all courses and practical exercises with a pass mark of 50%
Michener	almost 100%	traditional & PBL (online)	pass didactic courses with a 60% pass mark

Bridging programs

PROGRAM	RETENTION	CURRICULUM MODEL	PASS CRITERIA FOR ENTRY INTO CLINICAL PLACEMENT PHASE
SAIT	99%	traditional lecture/lab	50% overall mark; 70% on lab courses; CPR & First Aid, security clearance, immunization
Michener	80-85%	traditional lecture/lab	successful completion of courses iwth 60% pass mark; immunization
Mohawk	100%	traditional, PBL, online	completion of didactic courses (60% pass mark); immunization

APPENDIX B
CLINICAL PLACEMENTS SURVEY – ENGLISH

SURVEY ON CLINICAL PLACEMENTS
IN MEDICAL LABORATORY SCIENCE PROGRAMS
Canadian Society for Medical Laboratory Science
February 2004

Name of Institution ____

Type of Program ☐ MLT General ☐ Specialty

The Didactic Phase of the Program

1. What are the minimum entry criteria for your program (for example, marks, subjects completed)?

2. What kind of selection process is in place for screening students into your program?

☐ first come, first served

☐ interviews

☐ other (please specify)____________________________________

3. What experience with the laboratory do your students have before applying to or entering the program? (for example, are they required to visit a laboratory prior to acceptance)?

4. How many students applied to your program for the fall of 2003? ________________

5. How many students did you accept into your program for the fall of 2003? ___________

6. How has your class size changed in the last five years? Are there plans to change class size in the near future?

7. What is the average retention rate for your program?________________________

8. What impact, if any, do your institution's admission requirements and selection process have on your program's retention rate or on the overall student outcomes for your program?

9. How many weeks do your students spend in didactic instruction?________________

10. What is the pass mark for your didactic courses? __________________________

11. What conditions other than passing courses must your students meet before completing the requirements of the didactic program (for example, completion of CPR courses, projects) ?

12. How would you describe the curriculum model for your didactic program?

- ☐ traditional lecture/lab
- ☐ problem-based structure
- ☐ other (please specify)____

13. Has this didactic model changed in recent years? If so, how has the change affected student outcomes?

1.1 The Clinical Phase of the Program

14. How many clinical placements are available in your program? ________________________

15. How long has the current model of clinical instruction been in place in your institution?____

16. If you have changed the way you provide clinical instruction in the last five years, how did the previous model differ?

17. What criteria must students meet in order to enter the practicum phase(s) of the program?

18. How many students did you place in clinical sites in the current year? __________________

19. How many clinical sites participate in your program? _______________________________

20. How many weeks of clinical instruction do your students receive in total?_______________

21. Do your students spend time at more than one site for their placement?

22. Please help us to understand how your program's clinical instruction experiences are structured by filling in this table. What are the lengths of the individual rotations? If your placement program has more than 6 components, please use the margins or another sheet of paper.

Component (i.e., Haematology)	***Length of Rotation*** *(in weeks)*	***Instructor/Student Ratio***

23. At what point in the program does the clinical placement occur? (If your program makes use of staggered placements, please describe how these are timed in the program.)

24. In what ways are didactic instruction and clinical experience integrated? For example, with

- ☐ staggered practicums
- ☐ review/lectures during the practicum
- ☐ reflective exercises
- ☐ Other? (please specify) ____

25. What do you call the individuals who supervise the students through their clinical experience (i.e., preceptors, teaching techs, clinical instructors)?

26. What is the nature of the model for assigning clinical instructors? Are they…

- ☐ employees of the clinical site?
- ☐ employees of the educational institution who 'travel with' the students?
- ☐ other? (Please specify ____

27. What is the nature of the guidance that your instructors give during the clinical practicum? (Please check all that apply.)

- ☐ at-the-bench supervision
- ☐ lectures
- ☐ review sessions
- ☐ tests
- ☐ other (please specify) ____

28. What kinds of resources and support do your clinical instructors receive for their work with students? Are they financially compensated in any way?

29. What interactions does the educational institution have with the laboratory director, clinical instructors/preceptors, and students during clinical rotations?

30. Does your program use simulated laboratory experiences for learning during the practicum? If so, please state the types of activities undertaken in these laboratories and their lengths in weeks. What is the instructor to student ratio in these labs?

31. Do the students participate in any additional activities not related to the clinical site that contribute to their clinical education (for example, field trips, outside lectures) ?

32. How much tuition do students pay for their clinical year and to whom is it paid?

33. Do your students receive any compensation or financial support during their clinical placement?

34. What kind of compensation (if any) is in place for clinical sites and how is it administered?

35. In your experience, what are the costs and benefits of clinical education?

36. The following table presents a summary of the costs and benefits that have been attributed in the health professions literature to clinical placements of students. How do these match your experience? Would you add anything to the lists? Would you remove any items?

	Tangible	Intangible
COSTS	Staff time Educational materials Space and facilities Accreditation Liability, malpractice insurance Student-performed procedures Student waste Equipment repair Student costs: stipends, meals, parking, graduation, room & board, telephones	Stress Frustration Loss of esteem Responsibility burden Loss of instructor productivity Decreased staff efficiency

	Tangible	Intangible
BENEFITS	Student recruitment opportunities Student contributions to workload Increased instructor productivity Decreased costs for new personnel	Upgrading/PD opportunities for staff Improved staff performance Increased prestige for site Increased staff job satisfaction and morale Increased staff self-esteem Transferable skills of preceptors

37. Has your organization done any studies on costs and benefits of clinical education that you would be willing to share with us?

38. Has your program experienced challenges with clinical placements for your program (for example, withdrawal of participating sites, insufficient places, inability to expand the program due to lack of sites)? Please describe.

39. If you could make changes to your current clinical placement program, what would they be?

40. Is there any other information about your program that you feel would be helpful for us in understanding the nature of your clinical placement experience or its costs and benefits for any of the stakeholders in your program?

41. Are there any issues related to clinical placements that have not been touched on in this survey that you would like to bring to our attention?

APPENDIX C
CLINICAL PLACEMENTS SURVEY IN FRENCH

Nota: SVP répondre avant le 1er mars

ENQUÊTE SUR LES STAGES CLINIQUES DANS LES PROGRAMMES DE SCIENCE DE LABORATOIRE MÉDICAL

Société canadienne de science de laboratoire medical

Nom de l'établissement____

Type de programme ☐ TLM, Général ☐ Spécialité

L'aspect didactique du programme

1. Quels sont les exigences minimums d'inscription à votre programme (par exemple, notes, sujets complétés)?

2. Quel type de processus de sélection utilisez-vous pour choisir les étudiants de votre programme?
- ☐ premier arrivé, premier servi
- ☐ entrevues
- ☐ autre (veuillez préciser)____

4. Quelle expérience de laboratoire vos étudiants possèdent-ils avant de faire une demande ou de s'inscrire au programme? (par exemple, exige-t-on la visite d'un laboratoire avant de les accepter)?

4. Combien d'étudiants se sont inscrits à votre programme à l'automne 2003? ______________________

5. Combien d'étudiants avez-vous acceptés dans votre programme à l'automne 2003? _______________

7. Comment les effectifs de votre groupe ont-ils évolué au cours des cinq dernières années? Planifiez-vous accueillir des groupes plus importants dans un proche avenir?

7. Quel est le taux de maintien moyen des effectifs dans votre programme?__________________

8. S'il y a lieu, quel impact les conditions d'admission et le processus de sélection de votre établissement ont-ils sur le taux de maintien des effectifs dans votre programme ou sur les résultats globaux des étudiants de votre programme?

9. Pendant combien de semaines vos étudiants suivent-ils des cours théoriques?____________________

10. Quelle est la note de passage de vos cours théoriques? ____

11. Y-a-t-il des conditions autres que les notes de passage auxquelles vos étudiants doivent se plier avant de compléter les exigences du programme d'enseignement théorique (par exemple, compléter des cours ou des projets RCR) ?

12. Comment décririez-vous le modèle de cours de votre programme théorique?
- ☐ cours/laboratoires traditionnels
- ☐ structure d'apprentissage par problème
- ☐ autre (veuillez préciser)____

13. Ce modèle d'enseignement a-t-il changé au cours des dernières années? Si oui, de quelle façon le changement a-t-il affecté les résultats des étudiants?

1.2 La phase clinique du programme

14. Combien de stages cliniques sont disponibles dans votre programme? ___________________________

15. Depuis combien de temps le modèle actuel d'enseignement clinique est-il en place dans votre établissement? _________________________

16. Si vous avez modifié la façon de dispenser l'enseignement clinique au cours des cinq dernières années, en quoi le modèle précédent était-il différent?

17. À quels critères les étudiants doivent-ils répondre afin d'être acceptés dans la ou les phases pratiques du programme?

18. Combien d'étudiants avez-vous acceptés dans des stages cliniques dans l'année en cours? __________

19. Combien y-a-t-il de stages cliniques dans votre programme? ___________________________________

20. Combien de semaines d'enseignement clinique vos étudiants reçoivent-ils au total?________________

23. Vos étudiants participent-ils à plus d'un stage au cours de leur formation clinique?

24. Aidez-nous à comprendre comment sont structurées vos expériences d'enseignement clinique en remplissant ce tableau. Quelles sont les durées des rotations individuelles? Si votre programme comporte plus de 6 composantes, veuillez utiliser les marges ou une autre feuille.

Composante (ex. hématologie)	***Durée de la rotation*** *(en semaines)*	***Ratio instructeur/étudiant***

23. À quel moment au cours du programme le stage clinique a-t-il lieu? (Si votre programme comprend des stages échelonnés, veuillez décrire comment ils sont intercalés dans le programme.)

24. De quelles façons l'enseignement théorique et l'expérience clinique sont-ils intégrés? Par exemple, …

- ☐ stages échelonnés
- ☐ révisions/cours durant les stages
- ☐ exercices de réflexion
- ☐ autre? (veuillez préciser) ____

28. Quel titre donnez-vous aux personnes qui supervisent les étudiants qui sont en stage clinique (ex., précepteurs, techniciens en enseignement, instructeurs cliniques)?

29. Quelle est le modèle type sur lequel vous vous basez pour choisir les instructeurs cliniques? Sont-ils des…

- ☐ employés du laboratoire où se fait le stage clinique?
- ☐ employés de l'établissement d'enseignement qui 'se déplace' avec les étudiants?
- ☐ autre? (veuillez préciser) ____

30. Quelle est la nature de l'encadrement fourni par vos instructeurs pendant le stage clinique? (Veuillez cocher toutes les réponses pertinentes.)

- ☐ supervision directe, sur place
- ☐ cours
- ☐ sessions de révision
- ☐ examens
- ☐ autre (veuillez préciser) ____

28. Quels types de ressources et d'appui vos instructeurs cliniques reçoivent-ils pour leur travail auprès des étudiants? Reçoivent-ils une compensation financière quelconque?

29. Quelle interaction l'établissement d'enseignement a-t-il avec le directeur du laboratoire, l'instructeur/précepteur clinique et les étudiants durant les rotations cliniques?

30. Votre programme a-t-il recours à des expériences de laboratoire simulées pour l'apprentissage durant le stage? Si oui, précisez les types d'activités qui se déroulent dans ces laboratoires ainsi que leur durée, en nombre de semaines. Quelle est le ratio instructeur et étudiants dans ces laboratoires?

31. Les étudiants participent-ils à d'autres activités non reliées au stage mais qui font partie de leur éducation clinique (par exemple, sorties éducatives, cours ou conférences à l'extérieur) ?

32. Quels sont les frais de scolarité de leur année clinique et à qui paient-ils ces frais?

33. Les étudiants sont-il rémunérés ou reçoivent-ils une aide financière pendant leur stage clinique?

34. Quel type de compensation (s'il y a lieu) est prévue pour les stages cliniques et comment sont-ils administrés?

35. D'après votre expérience, quels sont les coûts et les avantages de la formation clinique?

36. Les tableaux suivants présentent un résumé des coûts et avantages, décrits dans la littérature des professions de la santé, reliés aux stages cliniques des étudiants. Correspondent-ils à votre expérience? Avez-vous des points à ajouter à ces listes? Retiriez-vous certains d'entre eux?

	Tangibles	**Intangibles**
C O U T S	Temps du personnel	Stress
	Matériel didactique	Frustration
	Espace et installations	Perte d'estime
	Agrément	Fardeau de responsabilité
	Assurance responsabilité, assurance civile professionnelle	Perte de productivité de l'instructeur
	Méthodes effectuées par l'étudiant	Efficacité réduite du personnel
	Gaspillage par l'étudiant	
	Réparation de l'équipement	
	Coûts reliés à l'étudiant : paiements à l'étudiant, repas, stationnement, cérémonie de remise des diplômes, pension, téléphones	

	Tangibles	**Intangibles**
A V A N T A G E S	Possibilités de recrutement étudiant	Possibilités d'avancement/DP pour le personnel
	Contributions de l'étudiant à la charge de travail	Amélioration de la performance de la part du personnel
	Productivité accrue de l'instructeur	Prestige accrue pour le site du stage
	Coûts moindres pour du nouveau personnel	Satisfaction au travail accrue, meilleur moral
		Estime de soi du personnel accru
		Compétences des précepteurs transférables

37. Votre organisation a-t-elle fait des études de rentabilité sur la formation clinique, que vous accepteriez de partager avec nous?

38. Votre programme a-t-il connu des problèmes reliés aux stages cliniques (par exemple, le retrait des sites de stages participants, un nombre de place insuffisant, l'impossibilité de développer le programme à cause du manque de sites)? Veuillez décrire la situation.

39. Si vous pouviez apporter des changements à votre programme de stages cliniques actuels, quels seraient-ils?

40. Y-a-t-il d'autre information concernant votre programme qui, d'après vous, pourrait nous être utile pour comprendre la nature de votre expérience de stages cliniques, ses coûts et avantages pour chacune des personnes responsables dans votre programme?

41. Y-a-t-il des sujets reliés aux stages cliniques qui n'ont pas été traités dans cette enquête et que vous aimeriez porter à notre attention?

APPENDIX D
LIST OF ACRONYMS USED IN THIS REPORT

The following acronyms/short forms are used in this report:

BCCA	British Columbia Cancer Agency, Vancouver BC
BCIT	British Columbia Institute of Technology, Burnaby BC
Cambrian	Cambrian College, Sudbury ON
CCNB-Campbellton	Université de Moncton (CNB-Campbellton), Moncton NB
Chicoutimi	Cegep de Chicoutimi, Chicoutimi QC
CNA	College of the North Atlantic, St. John's NF
Dawson	Cegep de Dawson, Montréal QC
Hotel Dieu deM	Hopital Hotel-Dieu de Montréal
Michener	Michener Institute of Allied Health Sciences, Toronto ON
Mohawk	Mohawk College, Hamilton ON
NAIT	Northern Alberta Institute of Technology, Edmonton AB
NBCC	New Brunswick Community College, Saint John NB
QEII/Dal	Queen Elizabeth II/Dalhousie School of Health Sciences, Halifax NS
Red River	Red River College, Winnipeg MB
Regina HDSDC	Regina Health District School of Diagnostic Cytology, Regina SK
Rimouski	Cegep de Rimouski, Rimouski QC
Rosemont/UdeM	College de Rosemont/Centre hospitalier de l'Université de Montréal
Rosemont	Cegep de Rosemont, Montréal QC
Saint-Hyacinthe	Cegep de Saint-Hyacinthe, Saint-Hyacinthe QC
Saint-Jean	Cegep de Saint-Jean-sur-Richelieu, St-Jean-sur-Richelieu, QC
Saint-Jerome	Cegep de Saint-Jérome, Saint-Jérome QC
Sainte-Foy	Cegep de Saint-Foy, Quebec QC
SAIT	Southern Alberta Institute, Calgary AB
Shawinigan	Cegep de Shawinigan, Shawinigan QC
Sherbrooke	Cegep de Sherbrooke, Sherbrooke QC
SIAST	Saskatchewan Institute of Applied Science and Technology, SK
St. Clair	St. Clair College, Windsor ON
St. Lawrence	St. Lawrence College, Kingston ON
UofA	University of Alberta, Edmonton AB
Winnipeg HSC	Health Sciences Centre/School of Cytology, Winnipeg MB

APPENDIX D

PHASE 2 SURVEYS DISTRIBUTED TO LABORATORY DIRECTORS, CLINICAL INSTRUCTORS AND STUDENTS

SURVEY ON THE COSTS AND BENEFITS OF CLINICAL PLACEMENTS FOR MEDICAL LABORATORY STUDENTS

Canadian Society for Medical Laboratory Science

Summer 2004

LABORATORY DIRECTORS

INSTITUTION CHARACTERISTICS

1. Name of institution/hospital

____

2. Location of your site: ❑ urban ❑ suburban ❑ rural

LABORATORY CHARACTERISTICS

3. How many full time staff are employed in your laboratory? ______________________

4. How many part time staff are employed in your laboratory? ______________________

CLINICAL TEACHING

For the purposes of this survey, technologists who are directly involved with teaching medical laboratory students will be called 'clinical instructors'.

5. How many staff members are assigned to clinical teaching responsibilities for medical laboratory students? ______________________

6. In what ways do your staff who are not clinical instructors participate in clinical education activities? ______________________

7. What is the salary scale for your clinical instructors? ______________________

8. Do your clinical instructors receive any compensation or recognition (monetary or otherwise) for their teaching responsibilities? ______________________

9. Do the students at your site receive any compensation or financial support during their clinical placement? ______________________

10. What other educational activities do students participate in at your laboratory site other than bench work and evaluation activities? ______________________

11. What percentage of students who train at your site have you hired in the past 5 years? ______

12. Does your institution/laboratory receive compensation for training laboratory students and, if so, how much and how is it administered? ______________________

13. If you could make changes to the current clinical education program, what would they be?

    ____

    ____

14. Is your laboratory in a position to increase the number of students it trains? If not, what is the reason? ____

THE COSTS AND BENEFITS OF CLINICAL EDUCATION

15. Do you have any perceptions about or data on the costs and benefits of clinical education for your laboratory? (i.e., hourly salaries of clinical instructors at differing seniority levels, education-related overhead costs, productivity figures related to clinical education) ________
____

16. Has your organization done any studies on costs and benefits of clinical education? If so, could you share the information with us? ______________________________

17. What contributions do medical laboratory students make to your laboratory? ____________
____

18. The following table lists the costs and benefits of clinical education as identified in the literature and in a survey of directors of Canadian medical laboratory programs. How do these items compare with your experiences? Please make comments on the table or on a separate sheet if necessary.

	Tangible	**Intangible**
COSTS	CLINICAL SITE • staff time • educational materials • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time: scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • graduation	CLINICAL SITE • decreased staff efficiency CLINICAL INSTRUCTORS • stress and frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction
BENEFITS	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced student assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of ‘grey areas’ of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

19. Do you have a sense of the distribution of costs that your laboratory would expend on education med lab students for each of the following items (i.e., as a percentage of 100%)?
    _____ staff time
    _____ educational materials
    _____ space and facilities
    _____ student-performed procedures
    _____ other related expenses (please specify) ______________________________________

Please return your completed survey by **July 24, 2004**. You may fax it to 416-233-6574 or e-mail your response to *moira.grant@utoronto.ca*. Thank you for participating in this research project!

SURVEY ON THE COSTS AND BENEFITS OF
CLINICAL EDUCATION FOR MEDICAL LABORATORY STUDENTS
Canadian Society for Medical Laboratory Science
Summer 2004

CLINICAL INSTRUCTORS & COORDINATORS

INSTITUTION CHARACTERISTICS

1. Name of institution/hospital ____
2. Number of technologists employed at your site: Full time _____ Part-time _____ Casual _____

CLINICAL TEACHING

3. How long have you been involved in the clinical education of medical laboratory students?
   ____
4. What are your responsibilities in your institution's clinical education program? __________________
   ____
5. How much of your working week is spent on education of students?___________________________
6. Are you 'released' from any regular non-teaching laboratory work in order to conduct your teaching activities? ____
7. Using the table, please describe the types of activities you are involved in as clinical instructor or coordinator and the proportions of teaching/coordinating-related time that each represents.

Clinical instruction activity	% of teaching time

8. Why are you involved in your site's clinical education activities and what do you get out of it?
   ____
   ____
9. What compensation/acknowledgement do you receive for activities related to clinical education?
   ____
10. If you could make changes to the current clinical education program, what would they be?
   ____
   ____

THE COSTS AND BENEFITS OF CLINICAL EDUCATION

11. Do you have any perceptions about or data on the costs and benefits of clinical education for your laboratory? (i.e., hourly salaries of clinical instructors at differing seniority levels, education-related overhead costs, productivity figures related to clinical education) If so, could you please share it?
   ____
   ____

12. What contributions do medical laboratory students make to your laboratory? ____________________
____

13. The following table lists the costs and benefits of clinical education as identified in the literature and in a survey of directors of Canadian medical laboratory programs. How do these items compare with your experiences? Please make comments on the table or on a separate sheet if necessary.

	Tangible	**Intangible**
COSTS	CLINICAL SITE • staff time • educational materials • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time: scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • graduation	CLINICAL SITE • decreased staff efficiency CLINICAL INSTRUCTORS • stress and frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction
BENEFITS	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced student assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of 'grey areas' of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

12. Do you have a sense of the distribution of costs that your laboratory would expend on educating med lab students for each of the following items (i.e., as a percentage of 100%)?

_____ staff time
_____ educational materials (reagents, disposables, photocopies)
_____ space and facilities
_____ other related expenses (please specify) ____________________________________

Please return your completed survey by **<u>July 24, 2004</u>**. You may fax it to 416-233-6574 or e-mail it to *moira.grant@utoronto.ca*. Thank you for participating in this research project!

SURVEY ON THE COSTS AND BENEFITS OF CLINICAL PLACEMENTS FOR MEDICAL LABORATORY STUDENTS
Canadian Society for Medical Laboratory Science
Summer 2004

STUDENT SURVEY

INSTITUTION CHARACTERISTICS

1. Name of institution/hospital ____

2. Location of your site: ❑ urban ❑ suburban ❑ rural

CLINICAL EDUCATION

For the purposes of this survey, technologists who are directly involved with teaching medical laboratory students will be called 'clinical instructors'.

3. At what stage are you in your clinical training?______________________________

4. How would you describe the importance of clinical education in your career preparation?
____
____

5. What role did clinical instructors play in your clinical education? ________________
____

6. How would you describe your clinical experiences in general? __________________

7. If you could make changes to the current clinical education program, what would they be?
____
____

THE COSTS AND BENEFITS OF CLINICAL EDUCATION

8. Based on your experience as a med lab student, where do you see your education incurring costs for your training laboratory?
____
____

9. Do you have a sense of the cost per student (in dollar figures) that your laboratory invests in training medical laboratory students? If so, could you please state/describe it?
____
____

10. What contributions do medical laboratory students make to the laboratory? ____________
____
____

11. The following table lists the costs and benefits of clinical education as identified in the literature and in a survey of directors of Canadian medical laboratory programs. How do these items compare with your experiences? Please make comments on the table or on a separate sheet if necessary.

	Tangible	**Intangible**
COSTS	CLINICAL SITE • staff time • educational materials • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time: scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • graduation	CLINICAL SITE • decreased staff efficiency CLINICAL INSTRUCTORS • stress and frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction
BENEFITS	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced student assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of 'grey areas' of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

12. Do you have a sense of the distribution of costs that your laboratory would expend on educating med lab students for each of the following items (i.e., as a percentage of 100%)?
    _____ staff time
    _____ educational materials
    _____ space and facilities
    _____ student-performed procedures
    _____ other related expenses (please specify) ____

Please return your completed survey by **July 24, 2004.** You may fax it to 416-233-6574 or return your response to *moira.grant@utoronto.ca* Thank you for participating in this research project!

APPENDIX E

TOPICS USED FOR ON-SITE INTERVIEWS WITH LABORATORY DIRECTORS, CLINICAL INSTRUCTORS, BENCH TECHNOLOGISTS AND CURRENT/FORMER STUDENTS

CSMLS STUDY ON THE COSTS AND BENEFITS OF CLINICAL PLACEMENTS
SAMPLE INTERVIEW TOPICS
LABORATORY DIRECTOR

Some of these questions might be pursued in greater depth if they appear to be directly relevant to the topic of costs and benefits of clinical education. Of course, you may choose not to answer some questions and you are welcome to introduce other topics into the conversation if you feel they would be helpful.

- How many full time/part-time staff are employed in your laboratory?
- How many staff members are assigned to clinical teaching responsibilities for medical laboratory students?
- In what ways do your staff who are not clinical instructors participate in clinical education activities?
- What is the salary scale for your clinical instructors?
- Do your clinical instructors receive any compensation or recognition (monetary or otherwise) for their teaching responsibilities?
- Do the students at your site receive any compensation or financial support during their clinical placement?
- What other educational activities do students participate in at your laboratory site other than bench work and evaluation activities?
- What percentage of students who train at your site have you hired as staff in the past 5 years?
- Does your institution/laboratory receive compensation for training laboratory students and, if so, how is it administered?
- If you could make changes to the current clinical education program, what would they be?
- Is your laboratory in a position to increase the number of students it trains? If not, please provide the reason.
- Do you have data that will help me to understand the costs and benefits of clinical education for your laboratory? (i.e., hourly salaries of clinical instructors at differing seniority levels, education-related overhead costs, productivity figures related to clinical education)
- Has your organization done any studies on costs and benefits of clinical education? If so, could you share the information with us?
- Do you have a sense of the cost per student (in dollar figures) that your laboratory invests in training medical laboratory students?
- What contributions do medical laboratory students make to your laboratory?

The following table lists the costs and benefits of clinical education as identified in the literature and in a survey of directors of Canadian medical laboratory programs. How do these items compare with your experiences?

	Tangible	**Intangible**
COSTS	CLINICAL SITE • staff time • educational materials • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time: scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • tuition fees • graduation	CLINICAL SITE • decreased staff efficiency CLINICAL INSTRUCTORS • stress and frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction
BENEFITS	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced student assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of 'grey areas' of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

Do you have a sense of the distribution of costs that your laboratory would expend on educating med lab students for each of the following items (i.e., as a percentage of 100%)?

______ staff time
______ educational materials
______ space and facilities
______ student-performed procedures
______ other related expenses (please specify) ____

Thank you for your support of this research project!
Moira Grant, PhD, MLT, ART
Research Associate, CSMLS

CSMLS STUDY ON THE COSTS AND BENEFITS OF CLINICAL PLACEMENTS
SAMPLE INTERVIEW TOPICS
CLINICAL INSTRUCTORS

Some of these questions might be pursued in greater depth if they appear to be directly relevant to the topic of costs and benefits of clinical education. Of course, you may choose not to answer some questions and you are welcome to introduce other topics into the conversation if you feel they would be helpful.

- How long have you been a clinical instructor?
- What are your responsibilities in your institution's clinical education program?
- Do you perform duties **not** related to clinical education for med lab students, and, if so, what proportion of your working time is spent on these activities?
- Describe the types of activities you are involved in as clinical instructor and the proportions of teaching-related time that each represents

Clinical instruction activity	% of teaching time

- Does the amount of time you spend teaching students vary with the student's/students' stage in their clinical rotation? If yes, can you express this in % for the beginning (_____), middle (_____) and end (_____) of the rotation?
- What compensation do you receive for your clinical instruction activities?
- If you could make changes to the current clinical education program, what would they be?
- Are you aware of any data that will help me to understand the costs and benefits of clinical education for your laboratory? (i.e., hourly salaries of clinical instructors at differing seniority levels, education-related overhead costs, productivity figures related to clinical education)
- Do you have a sense of the cost per student (in dollar figures) that your laboratory invests in training medical laboratory students?
- What contributions do medical laboratory students make to your laboratory?

The following table lists the costs and benefits of clinical education as identified in the literature and in a survey of directors of Canadian medical laboratory programs. How do these items compare with your experiences?

	Tangible	**Intangible**
COSTS	CLINICAL SITE • staff time • educational materials • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time: scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • tuition fees • graduation	CLINICAL SITE • decreased staff efficiency CLINICAL INSTRUCTORS • stress and frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction
BENEFITS	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced student assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of 'grey areas' of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

Do you have a sense of the distribution of costs that your laboratory would expend on educating med lab students for each of the following items (i.e., as a percentage of 100%)?

______ staff time
______ educational materials
______ space and facilities
______ student-performed procedures
______ other related expenses (please specify) ____

Thank you for your support of this research project!
Moira Grant, PhD, MLT, ART
Research Associate, CSMLS

CSMLS STUDY ON THE COSTS AND BENEFITS OF CLINICAL PLACEMENTS
SAMPLE INTERVIEW TOPICS
STUDENTS

Some of these questions might be pursued in greater depth if they appear to be directly relevant to the topic of costs and benefits of clinical education. Of course, you may choose not to answer some questions and you are welcome to introduce other topics into the conversation if you feel they would be helpful.

- At what stage are you in your clinical training?
- How would you describe the importance of clinical education in your career preparation?
- What role do clinical instructors play in your clinical education?
- How would you describe your clinical experiences so far?
- If you could make changes to the current clinical education program, what would they be?
- Based on your experience as a med lab student, where do you see your education incurring costs for your laboratory?
- What contributions do you and other medical laboratory students make to your laboratory?
- What costs do you see students incurring in their clinical education experiences?

(Please turn the page over)

The following table lists the costs and benefits of clinical education as identified in the literature and in a survey of directors of Canadian medical laboratory programs. How do these items compare with your experiences?

	Tangible	Intangible
COSTS	CLINICAL SITE • staff time • educational materials • space and facilities • student-performed procedures EDUCATIONAL INSTITUTION • educational materials • staff time: scheduling, meetings • accreditation costs • liability/malpractice insurance STUDENTS • relocation costs • tuition fees • graduation	CLINICAL SITE • decreased staff efficiency CLINICAL INSTRUCTORS • stress and frustration • burden of responsibility STUDENTS • stress • uneven quality of instruction
BENEFITS	CLINICAL SITE • recruitment opportunities • reduced hiring costs • decreased orientation for new personnel CLINICAL INSTRUCTORS • enhanced student assessment opportunities STUDENTS • enhanced marketability • facilitation of job search	CLINICAL SITE • improved staff performance • prestige • fulfilling a social responsibility • contribution to competent workforce CLINICAL INSTRUCTORS • increased job satisfaction, morale, self-esteem • transferable skills • upgrading/PD opportunities STUDENTS • hands-on experience in an authentic environment • correlation of theory with practice • working with patients and skilled role models • opportunity to hone skills, speed, judgement • appreciation of 'grey areas' of work • gaining Canadian experience where needed EDUCATIONAL PROGRAMS • recruiting appeal to potential students of hands-on experience as part of program

Do you have a sense of the distribution of costs that your laboratory would expend on educating med lab students for each of the following items (i.e., as a percentage of 100%)?

______ staff time
______ educational materials
______ space and facilities
______ student-performed procedures
______ other related expenses (please specify) ____

Thank you for your support of this research project!
Moira Grant, PhD, MLT, ART
Research Associate, CSMLS

APPENDIX F

CONSENT FORM USED FOR INTERVIEWS

CSMLS STUDY ON CLINICAL PLACEMENTS FOR MEDICAL LABORATORY TECHNOLOGISTS
PARTICIPANT CONSENT FORM

THE PROJECT

The goal of this study is to collect information on the costs and benefits of clinical placements for medical laboratory technologists (MLTs). There is a lack of clinical sites for educating medical laboratory students, which is hindering the expansion of programs needed to ease the workforce shortage of MLTS. Discussions of strategies to resolve this bottleneck are hindered by a lack of data on clinical placements. This study aims to fill in some of the information gaps.

THE RESEARCHERS

Dr. Moira Grant, a medical laboratory technologist, educator and researcher, and Kurt H. Davis, Executive Director of the Canadian Society for Medical Laboratory Science (CSMLS), are conducting this study for the CSMLS. The study is funded by Health Canada, which will receive a report on the data collected. The CSMLS has retained the rights to the raw data and to the conclusions reached through the study and plans to distribute these results to medical laboratory stakeholders, including study participants, by means of presentations and in publications in the Canadian Journal of Medical Laboratory Science.

WHY YOUR PARTICIPATION IS IMPORTANT

Decisions about clinical education are often based on economic considerations only and made without considering the perspectives of the stakeholders most affected by these decisions. By providing your insights on your experiences with clinical education, you can help to rectify this imbalance and ensure that a broader set of data are available when important decisions about clinical education for medical laboratory students are made.

YOUR PARTICIPATION

You are being asked to meet with the researcher for a 45 to 60 minute interview. All interviews are conducted at your laboratory site during work hours. Interviews address the clinical education questions included in lists sent to the contact person at your site. *Your participation in this project is voluntary and you may refuse to participate or withdraw from the study at any time without penalty.*

PRIVACY & CONFIDENTIALITY

Your participation in this study will remain confidential. While we would like to audiotape your interview, you are free to decline audiotaping or to turn off the recorder at any point during your interview. Your audiotape will not be transcribed but will be consulted to ensure that your comments have been accurately noted. All tapes will be securely stored in the office of the researcher and will be destroyed after all data is analyzed. Your name will not be used in the analysis and writing of the reports. While we may use quotes from your interview, they will never be attributed to you. Only the principal researchers will have access to the raw data.

CONSENT

I agree to participate in an interview for this research project. I am aware that my participation is voluntary and that I may withdraw at any time, without fear of penalty.

Print Name	Signature	Date	Province

CONTACT INFORMATION

If you have any questions about the project, please do not hesitate to contact Moira Grant at moira.grant@utoronto.ca or 416-234-0912.

APPENDIX G

INSTITUTIONS/INDIVIDUALS CONTRIBUTING TO THIS STUDY

Individual participants in the interviews and surveys conducted for this study were assured of the confidentiality of their responses. For this reason, only the organizations with which they are associated are listed here. However, there were some individuals who contributed to the data gathering beyond the requests originally made of them and they are acknowledged here as well.

Terry Chelich
Director, Laboratory Services
Calgary Health Region
Calgary AB

Dr. Everett Chalmers Regional Hospital
Fredericton NB

Children's Hospital of Eastern Ontario
Ottawa ON

Bill DuPerron
Principal Consultant
Alberta Health and Wellness
Edmonton AB

CEGEP de Rosemont
Montréal QC

Dynacare Kasper Medical Laboratories
Edmonton AB

Karen Gabriele
Medical Laboratory Program Director
Dawson College
Montréal QC

Jewish General Hospital
Montreal QC

London Health Sciences Centre
St. Joseph's Campus
London ON

Peggy O'Neill
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London ON

Jan Maxwell
Medical Laboratory Program Director
Person from St. Clair

Robin Power
Instructional Coordinator
Medical Laboratory Sciences Program
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St. John's NL

Aleatha Schoonover
Medical Laboratory Program Director
Saskatchewan Institute of Applied Health Sciences
Saskatoon SK

New Brunswick Community College
Moncton NB

Val Wolansky
Acting Team Leader
Medical Laboratory Program
Northern Alberta Institute of Technology
Edmonton AB