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11. The Clinician Scientist in Canada: Supporting Innovations in Patient Care through Clinical Research

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Abstract

Clinician Scientists are medical doctors who have undertaken additional training in health research or basic science. As both clinicians and researchers, these individuals play an essential and distinct role in the health care system. By virtue of their integrated activities, Clinician Scientists have an opportunity to undertake key aspects of the scientific research process (including, for example, formulating and testing hypotheses) within the clinical setting. The unique position and research mandate of Clinician Scientists permits them to adopt a more complex study and develop a more thorough understanding of disease. This ultimately makes the role of Clinician Scientists — and their contribution to research and its translation to practice — critical for driving health care innovation in Canada.

Despite the importance of — and contribution made by — Clinician Scientists, they are relatively few in number, comprising a somewhat small percentage of the total profession. There are many barriers to the recruitment and retention of Clinician Scientists, including the lengthy training time, the fact that there are fewer funding opportunities available to support both training and research, delayed financial reward, lower financial remuneration, overwhelming trainee requirements, insufficient guidance in the research environment, limited mentorship opportunities, and career demands. While some potential solutions to these issues have been generated both nationally and internationally (and some have been implemented), for the most part, the solutions have been local and small in scope and, as such, their success is difficult to determine.

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Barriers to changing the current status of the Clinician Scientist in Canada include a lack of understanding of — and support for — the importance of Clinician Scientists at national, provincial and institutional levels, as well as the daunting task of encouraging stakeholders (e.g., Faculties of Medicine, funding agencies, governments) to invest in a common commitment to making the necessary large-scale changes. Recommendations are put forward at the end of this paper to increase the recruitment and retention of Clinician Scientists in Canada.

Introduction and Background

Clinical research and practice should ideally function as a continuum, within which clinical knowledge flows from the laboratory to the bedside and vice versa. Despite the fact that there is an increasing appreciation of the science of educational research, new knowledge generated in the research setting that is relevant to clinical care is rarely applied to practice. Similarly, hypotheses that may be made by physicians at the bedside as part of patient care tend not to be tested empirically. In addition, moving knowledge from simple observations to research to widespread use is a complex and often inefficient process.[1]

Clinician Scientists play an important role in closing the gap between research and practice. These individuals are medical doctors who have undergone additional training in basic science or health services research. Their unique combination of skills allows Clinician Scientists to participate in clinical work that spans the full breadth of activities — from the researcher's bench to the clinician's bedside (i.e., where they perform patient care activities) and back again. Their skill set allows Clinician Scientists to translate their research results into the clinical setting and to develop research questions based on the clinical issues they encounter in practice. Clinician Scientists' research expertise covers a broad range of topics, from basic science studies in a laboratory to translational and patient-oriented clinical research to population health research and epidemiology.[2]

The proportion of the Clinician Scientist's time that is spent on research, in relation to other clinical, administrative or educational tasks, varies depending on the individual in question.[i] The role of Clinician Scientists and the subsequent division of their time may fall anywhere along the continuum from research to practice: with some Clinician Scientists doing less research in favour of other activities — clinical, administrative or educational in nature — and others doing more research and spending less time on other activities. For example, some Clinician Scientists may act as clinically trained full-time scientists and may do a small amount of clinical work, while other Clinician Scientists straddle both sides (e.g., maintaining a nationally funded program of research while remaining highly engaged in clinical work) and others may be located within Faculties of Medicine where their principal focus is on the translation of newly generated knowledge into clinical practice.

Many consider a true Clinician Scientist to be someone who satisfies the full breadth of translational science. Traditionally, translational science follows the "bench to bedside" approach, as more clearly defined by Waldman and Terciz (2010) and described in Appendix A. No matter the definition adopted, the role played by Clinician Scientists and their contribution to research is critical for driving health care innovation in Canada. As both clinicians and researchers, their integrated training allows them to apply a "clinical medical perspective to the broad spectrum of biomedical research" and their patient care activities provide opportunities for the formulation of hypotheses that can later be empirically tested, making for a more complex study and thorough understanding of disease than that which is possible within either the medical facility or laboratory environment alone.[3] Through their study of patients and human subjects, Clinician Scientists have made substantial discoveries

[i] In the 2013–2014 application cycle, the Canadian Institutes of Health Research (CIHR) gave a Clinician Scientist salary award only if a minimum of 75 per cent of the applicant's time was protected for research for the duration of the award.

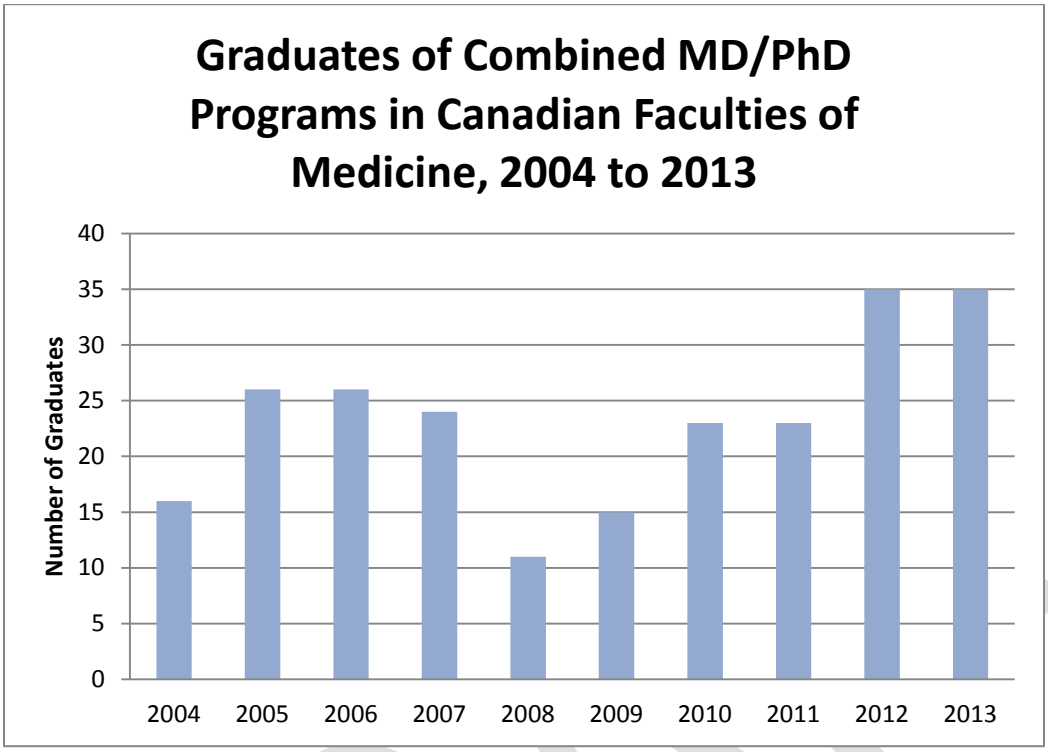
in disease mechanisms, pathogenesis and novel interventions. A case for the value of the Clinician Scientist is made by statistics on Nobel Prize award recipients between 1997 and 2003. Over this period, the majority of recipients were either independent researchers with both an MD and a PhD or recipients who were part of a research team that included at least one individual who had both an MD and a PhD designation.[3]

Currently, there are two primary formal pathways for one to become a Clinician Scientist in Canada: through a joint MD/PhD program or through the Royal College's Clinician Investigator Program (CIP). MD/PhD students engage in undergraduate medical and PhD studies, which culminate in the receipt of the dual-degreed designation. Joint MD/PhD programs take approximately between seven and eight years to complete. Alternatively, CIP trainees engage in research training at the level of a graduate degree program or post-doctoral fellowship (if the trainee has prior graduate degrees) concurrently with postgraduate medical education. CIP involves a minimum of 24 months of study (longer if doctoral studies are pursued) and is typically started during the third or fourth year of residency. In addition, other less formal pathways may have led professionals to practise as Clinician Scientists. These include physicians or surgeons who enter into clinical research later in their career or without a previous graduate degree such as a PhD.

National-level data on the exact number of Clinician Scientists currently practising in Canada cannot be ascertained with accuracy; however, it remains clear that this unique training results in a relatively small group of individuals. In order to contextualize this discussion, one high-level estimate suggests that 4,522 Clinician Scientists are practising across the country.[ii] In addition, estimates using the number of graduates in a given training route (i.e., through the CIP or a joint MD/PhD program) also yield relatively small numbers. For instance, since the program's first graduate in 1997, the Royal College's CIP has graduated a total of 404 individuals with this unique designation, at a rate of approximately 29 per year. As for the other formal training pathway, while the majority of Canada's medical schools do offer a joint MD/PhD program, the number of students in those programs remains limited. During the period 2004 to 2013, the total number of graduates of combined MD/PhD programs in Canadian Faculties of Medicine varied from 11 at the lowest to 35 at the highest. A total of 234 graduates have come through this pathway during the nine-year period.

[ii] The researcher's data set included individuals (including MDs and RNs) without a PhD and those with a PhD. All 4,522 individuals were unique investigators who had received a CIHR grant since 2000.

TABLE 1: Graduates of Combined MD/PhD Programs in Canadian Faculties of Medicine, 2004 to 2013



Source: Association of Faculties of Medicine of Canada, January 2014

Areas Requiring Change

While there is no argument about the critically important role played by Clinician Scientists, there are many theories as to why this role has been diminishing over time within the Canadian medical system. Some scholars have pointed to a decline in the number of Clinician Scientists both in Canada and internationally.[2,4-7] More recently, others have raised concerns about the amount of time Clinician Scientists have to allot to their intended purpose, namely direct, patient-oriented investigation.[8] It has also been argued that the diminishing role of Clinician Scientists is not a symptom of declining need.[8] In fact, with the ever-increasing expansion and complexity of heath care knowledge and services and the imperative of hospital efficiencies in light of stretched fiscal resources, Clinician Scientists are needed now more than ever.

Scholars have identified various obstacles that make it difficult for individuals to maintain a productive research career while, at the same time, to fulfill their clinical responsibilities. A large cohort of potential Clinician Scientists are likely to be dissuaded from research as a result of these obstacles, which include lengthy training time, fewer funding opportunities, delayed financial reward, lower financial remuneration, overwhelming trainee requirements, insufficient guidance in the research environment and career demands.[4]

Lengthy training time

The length of time required to complete the necessary training is a threat to the recruitment and retention of Clinician Scientists.[6,7,9,10] Research has revealed that approximately one-third (31 per cent) of CIP trainees noted that lengthy completion time (between seven and eight years) was a deterrent to pursuing the Clinician Scientist path.[11] Similarly, it is generally accepted that students in joint MD/PhD programs also require approximately seven or eight years to complete all of their undergraduate training requirements, and many may subsequently undertake postgraduate (i.e., residency) training. This can be compared to the three to four years required to complete an MD program.

Furthermore, research has revealed that Clinician Scientists in Canada have a small but statistically significant higher mean number of degrees (3.3) than non-Clinician Scientists (3.2); a fact that also confirms the perception of longer training times.[4]

Financial deterrents

Challenges related to securing funding for research and training

The need to secure funding is a common source of stress amongst Clinician Scientists; this was reported by 42 per cent of CIP alumni.[11] It appears that much of this stress is likely due to the perception that Clinician Scientists are at a disadvantage when they apply for funding.[10] Lander *et al* (2010) noted that because the research experience of the applicant is a factor when funding applications are judged, Clinician Scientists competing with full-time research scientists felt that they were less likely to accumulate grants than were researchers who had no clinical responsibilities.[4]

Available data on funding allocations and sources for CIP trainees highlights the difficulties they experience obtaining funding for training and research. For first-, second- and additional-year CIP trainees, funding sources were varied and included universities, hospitals, ministries of health, granting agencies and trainees' clinical earnings. Typically, trainees needed to seek additional, and often lower, sources of funding from sources other than the agencies (i.e., ministries of health) that support their clinical specialty and subspecialty training.[11]

Research suggests that there may be some discrepancy between the perceived barriers to funding for Clinician Scientists and actual support for this career category.[4] For example, a review of awards granted by CIHR for the period 2000/2001 through to 2008/2009 suggests considerable stability — and some growth — in research funding and training support for Clinician Scientists.[4] Similarly, in terms of research funding, awards to Clinician Scientists increased by more than 25 per cent, as compared with 5 per cent for non-clinical PhDs. However, Clinician Scientist-led grants funded under CIHR's Clinical thematic area decreased significantly from 61 per cent to 51 per cent over the period in question, suggesting that Clinician Scientists may be shifting their attention to research domains other than that of direct, patient-centred research.[4]

In some cases, however, data do suggest that the allotment of research awards has decreased in recent years. For instance, CIHR funded a total of 127 MD/PhD studentships

between 2000/2001 and 2008/2009; however, over 70 per cent of these awards were received between 2000/2001 and 2004/2005. This means that a smaller number of awards were available in the latter years.[4]

Delayed financial reward

Sizeable student loans incurred by medical students and the delay in earning a salary act as deterrents to potential Clinician Scientist trainees. Prolonged research training is likely to be devalued when Clinician Scientist trainees are at the point when they could expect to benefit from significant clinical earnings.[4,10]

Reduced remuneration

In Canada, physicians and surgeons may be paid according to a variety of models, such as a salary or fee-for-service model, depending on individual circumstances. Many Clinician Scientists working on a fee-for-service model may be paid a reduced income, as compared with full-time clinicians, owing to the fact that they may be claiming fewer direct, patient-care activities as part of their fee-for-service. Furthermore, no significant difference exists between median salary award amounts for Clinician Scientists and non-clinician PhDs.[4] Taken into consideration with potentially heavy debt burdens and delayed financial reward, these potential discrepancies in salary are a significant drawback to embarking on a research career.[4,7,9,12]

In addition, the funding mechanisms and salary support in Canada are likely to discourage clinical research.[2] Unlike funding bodies in the United States, CIHR does not permit investigators to include a salary for the principal investigator and co-investigator in the vast majority of grant proposals. As a result, Clinician Scientists need to derive their salary by way of clinical earnings and/or university salaries, leading many in the field to either conduct research in their off-hours or sacrifice their research time.[2]

Salary issues amongst Clinician Scientists have been mirrored internationally. For example, in Germany, where medical school is free, there is still an identifiable struggle to transition trainees into productive practising Clinician Scientists. Many trainees interested in science opt for purely clinical positions over research fellowships, where salaries are demonstrably higher and more likely to contain social security and retirement benefits.[9]

Clinician Scientist trainee requirements

Residents are faced with extraordinary pressure to master a vast amount of knowledge and skills throughout their training. The tension between mastering clinical knowledge while gaining experience as a Clinician Scientist can be overwhelming for trainees. Because the primary focus of MD and residency programs is on patients and care delivery, those pursuing additional research training experience more challenges as they try to balance both the required competencies to reach key milestones in their clinical work and, at the same time, earn the designation of scientist (that is, plan, conduct and interpret experiments with the same rigour as PhDs).[6,7,9,11,12] For example, in a recent survey conducted by the University of Toronto of the MD/PhD program, 58 per cent of trainees

believed that integration between clinical training and research needed to be improved; only 6 per cent were satisfied with the current level of integration.[6]

Insufficient mentorship for Clinician Scientist trainees

A significant body of literature points to the importance of mentorship for students in medical schools and those continuing in residency education.[6,10,11] However, due to demands placed on trainees, who often struggle to balance a mastery of research with clinical competencies, the importance of role modelling may be particularly heightened for those training to be Clinician Scientists. In this discipline, role models are an enormous source of support and guidance.[11] A literature review and an environmental scan revealed that mentorship is key to the success of the Clinician Scientist during training and career development.[6,10]

Despite the perceived importance for mentoring, evidence suggests that there is a lack of adequate mentorship for trainees in some Clinician Scientist tracks.[14-16] In response, some organizations (such as the American Neurological Association) and scholars have identified increased and improved mentorship, particularly for junior trainees, as a key priority to improve the training of Clinician Scientists.

Tools for trainees in the research environment

Many Clinician Scientist trainees may not receive sufficient support for conducting research. For instance, students who train in a research-driven environment typically have many resources available, such as grant administration staff, institutional review boards, animal protocol review committees, etc.[12] These supports can help students navigate regulatory and funding agency requirements, institutional grant sign-offs, biostatistical analyses, database management and other functions critical to research activities.[12] However, for Clinician Scientist trainees, having to navigate these research-related tasks alone may be an additional source of stress and could delay or preclude research activities.

Career guidance

One of the largest threats to the present and future sustainability of Clinician Scientist training may be the absence of infrastructure support for those who pursue this career. Unlike other models in physician specialty training, there is no identified physician scientist training track where Clinician Scientist is the primary outcome.[6] This reality

> limits trainees in being able to identify a clear career path, universities in designing a cohesive curriculum, academic health science centres in creating sustainable careers, governments in setting aside resources to train and support physician scientists, and regulatory bodies in recognizing/certifying physician scientist careers.[12]

A survey of current MD/PhD students and alumni at the University of Toronto revealed that Clinician Scientist trainees appear to be sensing the lack of a national career trajectory for Clinician Scientists. Trainees in CIP have noted that there does not appear to be a clear career path upon completion of their training, are unsure about the job market for Clinician Scientists and are uncertain about the source of their future salary.[6]

Career demands and the primacy of patient care

Upon completion of formal training, practising Clinician Scientists face many competing career demands, such as fulfilling institutional expectations for patient care, research activities and education. Institutional pressures to commit to more clinical work while balancing academic responsibilities can be very challenging for Clinician Scientists who wish to devote time to research activities.[7,12] The "patient comes first" prioritization, in tandem with hospital-based rules and regulations and coupled with the inability to claim salary time for research hours, can have an impact on the ability of Clinician Scientists to protect time to focus on research.[12]

Possible Solutions

Multiple recommendations have been put forward by experts to bolster the recruitment and career development of Clinician Scientists in Canada. In addition, many of the issues faced by Clinician Scientists and trainees are not unique to Canada, and many other countries, including the United States, the United Kingdom and Germany, have also engaged in similar discussions. As such, possible solutions generated both nationally and internationally are presented in this section.

Minimizing financial disincentives

In order to recruit more Clinician Scientist trainees, programs must offer financial incentives, including attractive stipends, loan repayment programs and a higher likelihood of built-in success.[7] However, as it stands, potential Clinician Scientists face various economic disincentives such as perceived difficulty obtaining funding, lower salaries and delayed remuneration. These economic disincentives are thought to be a key factor for Clinician Scientists choosing to spend more time in clinical practice as opposed to research.

Possible solutions for increasing salaries have been recommended and some have been implemented. For instance, it has been recommended that funding agencies be lobbied to increase the number and size of career support awards for Clinician Scientists, thereby reducing their dependency on clinical practice for their income.[10] Others have recommended that uniform policies for salary and infrastructure support for Clinician Scientists be created on an institutional level in order to encourage an increase in the number of Clinician Scientists.[4,6]

Salary supports/career awards for Clinician Scientists are available from both public and private organizations, as well as through some provinces. For example, a career award that covers 50 to 75 per cent of a Clinician Scientist's salary has been introduced in Quebec. An evaluation of CIHR's salary awards in general showed that recipients were able to set aside more time for research and were more productive (e.g., publishing, presenting findings at conferences).[17]

Another potential solution, the Alternative Relationship Plans (ARP) initiative introduced in the province of Alberta, responds to some of the funding challenges associated with a fee-for-service model. This alternative, available to physicians by application under either a Clinical or Academic ARP, is intended to develop alternate compensation strategies and might lead to optimized compensation and encourage innovation.

In the United States, initiatives have been passed to encourage heavily indebted young professionals to enter careers in clinical research. For example, individuals may qualify for up to $35,000 in tax-free debt relief for two years with eligibility for a third year.[5]

With respect to increasing research funding, it should be noted that those in clinical work are at a unique advantage in terms of access to research in the primary care setting. CIHR has developed specific Clinician Scientist awards and MD/PhD scholarships; however, the success of these programs has been mitigated by recent reductions in available research funds.[9]

Protecting research time

Possible solutions have been identified for creating opportunities for Clinician Scientists to maintain clinical practice while having protected research time. Institutions in Germany have introduced a program designed to employ part-time replacement clinicians who take over the clinical duties of Clinician Scientists on a rotational basis. Qualitative findings have revealed that this initiative has allowed Clinician Scientists to spend more time focusing on their research activities.[9]

Integrating clinical and research training requirements

For both Clinician Scientist pathways (MD/PHD program and CIP), the time periods dedicated to clinical and research training are generally distinct.[6] When clinical and scientific tracks are run in parallel, the integration between the two domains is limited. Better integration of curricula between clinical and scientific programs would likely enhance a learner's knowledge of the links between science and clinical medicine and help the learner better conceptualize medical problems within a scientific framework.[6] In addition, creating a better integration between the clinical and scientific programs may help to decrease the stress associated with mastering both fields, shorten the length of training and better prepare trainees for career opportunities.[6] In order to encourage this integration, it has been recommended that a coherent Clinician Scientist education platform be developed, one that differs from the undergraduate medical and PhD programs.[6]

Designing innovative models of training and education

Many jurisdictions worldwide have considered competency-based models of medical education in both the undergraduate and postgraduate realms in an effort to ensure that training is optimally designed and focused on the achievement and demonstration of competencies. The Royal College of Physicians and Surgeons of Canada launched the *Competence by Design* program, which is intended to usher in a new era of competency-based medical education. As part of this and other related initiatives to reconsider the design of medical education, it may be prudent to engage further expertise to determine how a competency-based model could be employed within training programs such as the CIP and joint MD/PhD programs to optimal advantage.

In addition to considerations of competency-based education, innovative models may also involve the deployment of accelerated training. Retrospective evidence from an accelerated MD program at the University of Miami Miller School of Medicine has important implications

for the development of Clinician Scientists. The “PhD to MD” program was instituted in the 1970s and was in place for 18 years. Called a “radically different approach to medical education,” the program was designed to take students with a prior PhD in the sciences, mathematics or engineering and to grant them entry into a two-year, accelerated MD program. Research from a 2008 study focused on the long-term outcomes for these students suggests promising results: the majority of graduates were working in academic university medical departments. Twenty years post-graduation, graduates held many senior positions, including 85 full professors, 11 university directors/division heads, 14 academic chairs, 2 medical school deans and 1 astronaut.[18]

Role modelling as one prepares for practice

It has been recommended that mentorship and guidance programs be developed to help guide trainees from their initial decision to join the Clinician Scientist program through to employment.[6] Specific support should be available for the various obstacles trainees may face, including making transitions, looking for a job, making academic or career choices, maintaining a work/life balance, and integrating clinical and research roles.[6]

Barriers to Change

As noted above, some progress has been made in reducing barriers to the recruitment and maintenance of Clinician Scientists in Canada. However, Clinician Scientists and their trainees still perceive important barriers to working in this area — barriers they believe act as fundamental disincentives toward pursuing a career as a Clinician Scientist.[4] At the present time, the programs and policies that have been implemented have been piecemeal initiatives rather than an overarching strategy.[4] Unfortunately, large-scale change is daunting, as it will require that medical schools, postgraduate training programs, teaching hospitals, funding agencies and governments become involved in the process.[8]

Before significant change can be made on the more specific barriers, such as financial remuneration, large-scale change needs to occur to increase the perceived value of the Clinician Scientist. Currently, it appears that there is a lack of understanding of the Clinician Scientist’s role at the national, provincial and institutional levels.[6] While there is a recognition of the role of clinicians in patient care, it is not balanced with the equally important recognition of the clinician as a key — and essential — participant in medical research, a role that has the potential to improve the health of all.[7] Furthermore, while generalism is an important value in medical care delivery, the clinical research undertaken by this highly focused group of individuals speaks to the significant need to ensure a meaningful balance between both generalists and specialists in the health care system.

This lack of understanding for the role of the Clinician Scientist threatens the sustainability of programs, funding, salary allotments, protected time and enthusiasm by faculty and mentors. In order to introduce change in recruitment and retention, an environment must be created within medical schools and postgraduate programs that places greater value on clinical research and the Clinician Scientist’s career path.[8] In order to attract a new generation of Clinician Scientists, the academic environment must emphasize that their efforts are essential to improving the health of people everywhere. This may occur by

communicating to students the importance of — and excitement in being involved in — future discoveries in biomedical science.[8,10]

Furthermore, there is concern that the gap between biomedical research and clinical practice is widening.[7] There is debate about the presence and importance of both science and research in the medical curriculum. Any de-emphasis of scientific training in medicine may result in fewer science-interested students entering medical programs and fewer opportunities to ignite their interest in medical research.[6] To face these challenges, the various stakeholders — all of who have a common commitment to change — must work to increase the perceived value of Clinician Scientists in Canada.

Conclusion

Supporting the development and career sustainability of Clinician Scientists brings a multitude of benefits. The role of the Clinician Scientist is central to the discovery, application and communication of clinical knowledge. Clinician Scientists are in a unique position to participate in clinical work that spans the full breadth of activities from research to practice, enabling them to translate their research results into the clinic and to develop research questions based on clinical issues they encounter in practice. This breadth of knowledge is critical to advancing science and education; increasing knowledge and understanding of the mechanisms of disease; contributing to clinical trials; developing novel medical technology; ensuring patient safety; promoting health; and creating evidence that will have an impact on public policy.[6] Thus, continued and increased support mechanisms for Clinician Scientists in their development and careers is essential if Canada wishes to lead in medical research, innovation and the sustainability of a health system that cultivates better health for all Canadians.[6]

Recommendations

1. The Royal College should support the development of the next generation of clinical academics.

a) In tandem with the *Competence by Design* program and other national initiatives that will promote a hybrid, competency-based approach, the Royal College should advocate for a competency-based training scheme in the Clinician Scientist program that would optimize training in programs that span the continuum of medical education (i.e., undergraduate, postgraduate and continuing professional development).
b) Flexible pathways – Through avenues such as Fundamental Innovations in Residency Education (FIRE) and *Competence by Design*, the Royal College should examine how to make existing pathways, such as the CIP, more flexible in order to develop future Clinician Scientists by testing alternative infrastructures that support and foster them. Competency-based curricula could help to introduce academic careers at either the undergraduate or postgraduate training levels.
c) Integration points and transitions – The Royal College should develop mechanisms to permit smooth transitions from medical school to residency and residency to early Clinician Scientist practice, with opportunities to continue research in residency. The Royal College should also facilitate the development of flexibility in the integration points between CIP and the home program.

d) Protected time – The Royal College should encourage that defined protected time — mixtures of defined, individual specific time allocations (e.g., days per week) and blocks of extended time (e.g., months) be built into a competency-based curriculum.

Specific mechanisms and short-term actions might include:

- The Royal College should better market the CIP's Distributed Curriculum Training pathway amongst medical students to increase the opportunity for transition and recognition of research undertaken by medical students during undergraduate medical education as part of their CIP training.
- A mentorship program for prospective Clinician Scientists should be established and it should be available across the continuum of medical education — from medical school to residency — to assist in smooth transitioning and act as a model for balancing clinical and laboratory work.

2. The Royal College should support the career development of Clinician Scientists.

a) Recognition – The Royal College should advocate for the reintroduction of financial supports and recognition in the form of a 10-year career award and the development of mid-career awards.
b) Promotion – The Royal College should strike a task force to develop implementation guidelines that embed education scholarship (and the attendant metrics) within the promotion process and value education scholars as equal to all other forms of research.

3. The Royal College should strike a task force focused on issues pertinent to research in postgraduate medical education.

4. The Royal College should advocate that Clinician Scientists be included in the governance structure of the major national funding organization (i.e., CIHR) in order to ensure that the needs and background of these individuals are represented.

5. Through their Awards and Grants program, the Royal College should assist Clinician Scientists with the final resources needed to support their scholarship initiatives for PhD and/or post-doctorate training.

6. The Royal College should advocate that a national database be developed to track the current numbers and status of Clinician Scientists in Canada — both CIP graduates and those from other pathways — including their outcomes after graduation and information on their current patterns of work.

Appendix A: The Six Levels of Clinical and Translational Science

T0	Recognizes the contribution of the laboratory-based investigators to interatively shape and enhance the technologies that progress through the other stages of research
T1	Where new discoveries in the laboratory are first translated to human application (phase I and II clinical trials); emphasizes the difficulty in translating advanced technology from the laboratory to humans and reflects the challenges in finding the resources to facilitate the process of early translation
T2	Where candidate health applications emanating from the prior step progress through clinical development to engender the evidence base for integration into practice guidelines (phase III studies and clinical efficacy/economics)
T3	Where new knowledge from T1 and T2 are disseminated into community practice; requires significant investment in health services research, community-based participatory research and comparative effectiveness research
T4	Where scientific knowledge is used to inform disease prevention; this has an impact on the development of public health policy and population research
T5	Recognizes the global impact of knowledge translation and the societal need to improve the wellness of populations by reforming sub-optimal social structures (e.g., poverty, social imbalance, hunger); requires input from political and social scientists, engineers, economists, anthropologists, and population biologists into efforts that recognize the needs of the global village

Adapted from the following: Waldman SA and A Terzic. 2010. Clinical and translational science: from bench-bedside to global village. *Clinical and Translational Science*. **3** (5): 254–7

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