

# Supporting Clinician-Scientist Training in Canada

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*Approved: SGM 2016*



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## Executive Summary

Clinician-scientists are physicians with both clinical and formal research training. They occupy a unique niche as specialists in basic and translational research, and have historically played an important role in advancing medical science and bringing these advances from bench to bedside.

However, despite there being widespread acknowledgement of the important role of clinician-scientists in today's landscape of evidence-based medical practice, clinician-scientist training in Canada has been on the decline. The share of clinician-scientists with a significant research component in their career has been on the decline while the average age of newly graduated clinician-scientists who secure their first major research grant has risen dramatically. Barriers to retention in clinician-scientist training programs and successful advancement to a research career that have been identified include significant financial barriers, protracted training times and a consistent lack of appropriate mentorship.

There are clear benefits in improving clinician-scientist training programs. These include increasing Canada's capacity to produce a cohort of physicians who are interested and able to launch meaningful programs of research and strengthening our ability to move research findings to clinical application in an age where the gap between bench and bedside is wider than ever.

The CFMS represents those clinician-scientists trainees who are enrolled in MD-PhD programs and therefore has an interest in improving clinician-scientist training.

We provide three recommendations for strengthening clinician-scientist training in Canada: 1. Support existing efforts to establish a system of collecting data on clinician-scientist training program enrollment and outcomes, 2. Join the call for the CIHR to lead the creation of a national funding program and a national oversight body for clinician-scientist training programs and 3. Support closer integration of clinician-scientist trainees with their colleagues in medical training during research phases of their training.

## 1. Introduction

Medical students spend years learning about the thousands of medical and surgical interventions that have been invented to cure or alleviate the suffering of patients. Before entering practice, new physicians swear to do no harm to their patients. But what does that oath mean when most of those interventions trade between intended effects and side effects? What does it mean to provide evidence-based medical care when we only understand the full ramifications of new medications years after they hit the market?<sup>1</sup>

Where the clinician treats, the clinician-scientist (alternatively referred to as physician-scientist or clinician-investigator) reflects on the nature of that treatment. Strictly speaking, clinician-scientists are physicians who have undertaken additional research training and assume roles in academia that combine medical practice with health or basic science research.<sup>2</sup> More broadly, while medical schools in Canada are expected to train all medical students to employ the modes of reflection and exploration as defined by the CanMEDS Scholar role,<sup>3</sup> clinician-scientists are true experts in the scholarly aspects of medicine. Clinician-scientists, then, participate in medical practice, perform health and science research and lead the cultures of medical practice and education towards continuous improvement, innovation and reflection on current methods of providing medical care.

## 2. Existing Clinician-Scientist Training Programs

Clinician-scientist training has become an area of focus in Canadian medical schools and residency programs due to an urgent need for a greater number of medical professionals carrying out patient-oriented research.<sup>4</sup> Currently, 12 of the 17 medical schools in Canada offer one or more programs that combine medical and graduate research training.<sup>5</sup> In this section, we outline the existing pathways that provide research training opportunities at different stages of medical training.

### *MD-PhD*

In response to the increasing concern in the United States about the decline in the number of physicians with biomedical research as a component of their careers, the US National Institutes of Health (NIH) initiated the highly competitive and prestigious Medical Scientist Training Program (MSTP) in 1964.<sup>6</sup> Students in the MSTP stream had both clinical and formal research components in their training, obtaining both an MD and a PhD at its conclusion.

Joint MD-PhD programs grew rapidly in US over the next two decades, producing a steady stream of outstanding medical scientists who were leaders in both academic

research and clinical practice. In 1984, the University of Toronto was the first institution in Canada to establish a MD-PhD program, followed by McGill University and the University of British Columbia in 1985. In the last 30 years, MD-PhD programs have expanded nation-wide to the University of Alberta (est. 1997), University of Western Ontario (est. 2000), University of Ottawa (est. 2010) and University of Manitoba (est. 2010). As of 2011, there were a total of 170 MD-PhD trainees across the country.<sup>7</sup>

The curricula of Canadian MD-PhD programs are reminiscent of their US counterparts. Generally, students are admitted into MD-PhD programs following their undergraduate or master's degrees, and proceed to complete all of the requirements for medical school and a doctoral degree in approximately eight years. While there are some variations in curriculum design, in most programs students first undertake the preclinical years of medical school, pause from medical school to complete a doctoral degree and then return to complete their clinical years.<sup>8</sup>

In 1995, the Canadian Institutes of Health Research (CIHR) developed a MD-PhD Studentship Program grant. The current iteration of this grant is awarded annually to MD-PhD Program Directors and individually administered at each institution. In 2010, 52% of MD-PhD trainees (88/170) nation-wide were fully funded. Many trainees still needed to apply for other funding sources (e.g. CIHR Banting and Best Doctoral Awards and other internal and external opportunities) for support.<sup>7</sup> The CIHR MD-PhD Program Grants represent 0.15% of CIHR's \$1.8 billion annual operating budget.<sup>9</sup>

### *Clinician Investigator Program (CIP)*

In 1995, the Royal College of Physicians and Surgeons of Canada established the Clinician Investigator Program (CIP) in response to concerns about increasing shortages of clinician-scientists. The major goal of the CIP is to assist in the career development of clinician-scientists by providing a minimum of two years of structured, rigorous research training during residency. CIP was first offered with both graduate degree and non-degree options. The non-degree option was discontinued in 2008, and presently the CIP leads to a Master's degree at minimum.<sup>10</sup>

Available pathways for integrating CIP with clinical specialty or subspecialty training include the following: 1. Continuous Training Pathway: a minimum of 24 months of continuous, intensive research training, which can be done at different points during residency, 2. Distributive Curriculum Training Pathway: a minimum of 27 months of research training distributed in the last years of residency training, 3) Fractionated Training Pathway: 12 months of research during clinical training in blocks of three months or longer, with an additional year of continuous research training. In spite of demanding research requirements, most CIP trainees are able to overlap a portion of

their research and clinical training and dropout rates from these programs have been consistently low.<sup>10</sup>

The sources of funding for CIP training are more diverse than those of MD-PhD programs. These include universities, hospitals, provincial Ministries of Health (MOH), government granting agencies (e.g. CIHR), private foundations and trainee clinical earnings. MOH support for CIP varies between year of training and between provinces. To date, external awards have contributed more to support trainees during senior years of the CIP.<sup>10</sup>

Recent data indicated that approximately 67% of CIP alumni had attained an academic position, commonly in a clinical department and often as an assistant or associate professor. Most CIP graduates reported publishing an average of six journal articles on research conducted during CIP training. The number of publications related to CIP research was higher for those with a higher academic rank and for those with more elapsed time since completing CIP training.<sup>10</sup>

### *Importance of Research Training*

There is a growing trend towards integrating research training into undergraduate medical education. The importance and compulsoriness of this trend has been greatly highlighted by the Boyer Commission on Educating Undergraduates in the Research University.<sup>11</sup> Exposure to scientific research promotes scientific output, encourages interest in prospective research activities and ultimately facilitates access to clinician-scientist (research-focused) professions.<sup>12,13</sup> In addition, at the present time, research expertise is a highly desired, if not requisite, competency for every well-trained medical practitioner.<sup>14</sup>

### **3. The Decline in Clinician-Scientist Training**

Despite the importance of clinician-scientists in contributing to medical knowledge and advancing evidence-based medicine, clinician-scientist trainees in Canada today face increasingly numerous challenges.

Medical school tuition fees have risen dramatically across the country over the past two decades. For example, between the years of 1997 and 2000, medical school tuition in Ontario increased by an average of 116%.<sup>15</sup> Medical students can now expect to need to take out loans of well over \$100,000 and receive very little financial support from the government.<sup>16,17</sup> While this trend impacts all medical students, MD-PhD trainees are disproportionately affected since they spend longer in school and delay the start of their income by several years compared to their peers.<sup>18</sup> Another deterrent for students is the lack of integration between research training and medical education. In a report by the Task Force on Physician Scientist Education,

58% of MD-PhD trainees in the University of Toronto MD-PhD program believed that the integration model of research and clinical training needed to be improved.<sup>19</sup>

A decline in the popularity and viability of the clinician-scientist career pathway also poses a problem. Data from the US indicates that there has been a steady decline in trainees choosing to do a postdoctoral fellowship instead of a residency following undergraduate medical education. Furthermore, there is a decline in the number of clinician-scientists who hold primary appointments in a basic science department.<sup>20</sup> Combined with the rising average age at which new clinician-scientists obtain their first major research grant presents a serious threat to the clinician-scientist career pathway. A study from the University of British Columbia indicated that securing salaries and funding for research was one of the key barriers for newly trained clinician-scientists.<sup>21</sup> Clinical faculty members typically earn more than research faculty members, largely due to academic centers paying clinician-scientists less for time spent on research commitments. The lower salaries of clinician-scientists that spend a significant amount of time in research compared to their colleagues in the same clinical specialty is another barrier to recruiting and retaining clinician-scientists.<sup>2</sup>

Clinician-scientist training in Canada is currently in a period of turmoil. Funding for MD-PhD programs has undergone substantial changes in recent years. In June of 2015, the CIHR announced the termination of the MD-PhD Program Grants starting in 2016.<sup>22</sup> This move was a significant blow to clinician-scientist training in Canada, removing a significant incentive for students looking to apply to MD-PhD programs in this country. Many experts raised questions on this sudden decision, especially in light of a shortage of clinician-scientists.<sup>23</sup>

#### **4. Strengthening Clinician-Scientist Training**

##### *Benefits*

There is considerable evidence showing that graduates of clinician-scientist training programs prefer to pursue a career focused on research and are more likely than their MD-only peers to express an intention to pursue research.<sup>20,24-26</sup>

##### Interest in research-focused careers

Perhaps unsurprisingly, trainees in clinician-scientist programs are more likely to have an interest either pursuing research as a primary component of their career or to have research as a significant component of their clinical practice. In a survey of nearly 80,000 residents and practicing physicians who graduated from US medical schools, respondents who had graduated from MD-PhD programs were significantly more likely to indicate they were planning on pursuing a career either “exclusively” or

“significantly involved” in research (81.2%) compared to respondents who had graduated from MD-only programs (11.0%).<sup>24</sup>

Early interest in research amongst clinician-scientist trainees correlates with greater involvement in research during professional practice. A 2010 study on the career trajectories of former trainees in 24 US MD-PhD programs revealed that 81% were employed in academia, research institutes or the private sector and that two-thirds reported devoting more than half of their time to research.<sup>20</sup>

Nevertheless, there appears to be a decline in the overall percentage of graduates from clinician-scientist programs involved in research. A 1991 study of 72 graduates of the Washington University MSTP program who showed that 62 (86%) were employed in academic institutions, and that 60 (83%) reported spending at least 75% of their time in research.<sup>25</sup> This data is consistent with the observation that clinician-scientists today are both less likely to be involved in research and tended to obtain their first major research grant at a later age than in the 1980's, with the average age for first-time R01 grant holders increasing from 37 in 1985 to 44 in 2011.<sup>27</sup>

### Strengthening translational research

Clinician-scientists play a vital role in both advancing medical knowledge and, perhaps more importantly, in bringing new findings in the laboratory to novel clinical applications at the bedside.<sup>2</sup> Although funding for medical research has more-or-less grown over the last couple of decades, there has not been a corresponding rise in the number of new innovations in the clinic.<sup>28</sup> The gap between medical research and medical practice has not shrunk.

While it is difficult to quantify the precise impact clinician-scientists have on the process of translating research into clinical practice, observational data suggests that there is a correlation between the expanding gap between research and practice and the decline of clinician-scientists over the past half century.<sup>28,29</sup> This trend is partially attributable to the separation of clinical and basic research that has been occurring since the 1970's. Whereas in 1970 the number of NIH grants awarded to MD investigators approximately matched the number going to PhD investigators, by 2005 PhD investigators received 2.5 times more grants than MD's.<sup>28</sup> Simultaneously, while the number of clinicians has increased in the past four decades, the number of clinicians involved primarily in research has remained static.<sup>30</sup>

Clinician-scientists are uniquely poised to bridge the gap between the bench and the bedside. According to a 2014 report from the Royal College of Physicians and Surgeons of Canada Clinician Scientist Working Group,<sup>2</sup> the integrated training received by a clinician-scientist allows them to incorporate a clinical perspective on biomedical research and to use experience gleaned from patient care to help formulate clinically-relevant research questions.



## *Barriers*

### Financial

Whereas in the US the NIH provides full salary support for MD-PhD trainees in approved MSTP programs, funding in Canada has relied on a mixture of CIHR awards, provincial training awards and institution-specific grants.

The problem of a lack of sustained and stable funding during training is exacerbated by delayed time to earning a salary and in reduced remuneration. Clinician-scientist trainees often finish training significantly later than their clinical peers, with between 3-6 years on average of delayed time to completion of training.<sup>2,18</sup> As detailed in **Section 4**, clinician-scientists in practice can also usually expect a reduced income compared to colleagues in their clinical specialities. For these reasons, there has been a devaluation of the attractiveness of clinician-scientist training, leading to less trainees choosing to incorporate formal research training and less clinicians from incorporating research into their careers.<sup>30</sup>

### Length of training

The lengthy nature of formal clinician-scientist training programs is recognized as a significant deterrent to the recruitment of new trainees. On average it will require an MD-PhD trainee in Canada 7-8 years to complete their training, versus 3-4 years needed by MD-only students.<sup>2</sup> This is compounded by the need to pursue post-graduate training including lengthy residencies and oftentimes fellowships after that in order to secure an academic position.<sup>2,18</sup>

At the CIP level, a similar observation was found where 31% of trainees noted that a lengthier residency time (7-8 years on average) is a deterrent to pursuing formal research training.<sup>10</sup>

### Lack of mentorship

Due to the unique position of the clinician-scientist trainee being caught between two different training systems, it is recognized that successful mentorship is key in successful completion of training and in obtaining a career as a clinician-scientist.<sup>2,10</sup> In a 2014 survey of University of Toronto MD/PhD and CIP trainees, an overwhelming majority (99%) indicated that good mentorship was crucial in becoming a successful clinician-scientist.<sup>31,32</sup>

## 5. Recommendations

*Recommendation #1: Support existing efforts to establish a system of collecting data on clinician-scientist training program enrollment and outcomes*

A central barrier to strengthening Canadian clinician-scientist training programs is a lack of data on enrollment in these programs and their outcomes in terms of how many graduates of these programs go on to pursue research intensive careers and obtain research grants. There is also limited data on how clinician-scientist training programs across the country are funded, especially at the CIP level. These factors contribute to a situation where it is impossible to make evidence-based decisions on how to most effectively administer clinician-scientist training programs because the evidence simply does not exist.

The Clinician Investigator Trainee Association of Canada (CITAC), the national body that represents MD-PhD and CIP trainees, is currently in the process of collecting this data in collaboration with UBC and the Canadian Society for Clinical Investigation (CSCI). We recommend that the CFMS take part and contribute to the collection of this information by working with CITAC on this initiative.

*Recommendation #2: Join the call for the CIHR to lead the creation of a national funding program and a national oversight body for clinician-scientist training programs*

In comparison to the US, Canada lacks an organized central approach to supporting and overseeing clinician-scientist training programs. Whereas the NIH provides salary support to a significant portion of MD-PhD training programs in the US, the CIHR has recently eliminated financial support for Canadian MD-PhD trainees. The CIHR has also historically not collected any data on clinician-scientist training programs in Canada, despite being the agency best poised to do so. This has contributed to the lack of data on Canadian clinician training programs.

We recommend that the CFMS support the existing call being made by CITAC, CSCI and a number of MD-PhD programs across the country for the CIHR to either re-establish funding for MD-PhD programs or to create an alternative funding program. We further recommend that the CFMS call for the establishment of a national oversight body for clinician-scientist training programs, recognizing that it is crucial that the CIHR assume responsibility for ensuring that Canada is able to produce the number of clinician-scientist needed to meet the increasing demand for medical research that is translational and can be applied to patient care.

*Recommendation #3: Support closer integration of clinician-scientist trainees with their colleagues in medical training during research phases of their training*

Lengthy training time and a lack of mentorship and support are two major barriers identified by clinician-scientist trainees to successfully completing their training. Part of this problem stems from the isolation experienced by these trainees during their education, particularly when transitioning from clinical to research training or vice versa. The Association of Faculties of Medicine of Canada states that “education of clinician-scientists happen all across the continuum, not at a single interval.” Therefore, by promoting better integration of clinician-scientist trainees with their colleagues in clinical-only training programs, the experience of being engaged in research and medicine simultaneously is enhanced.

We recommend that the CFMS promote programs that seek to establish ongoing contact between MD-PhD trainees and their MD-only peers for the duration of the MD-PhD trainee’s research training. These programs could promote contact that is either academic or social in nature.

## **6. Conclusions**

Clinician-scientists are in a unique position to advance translational research programs that further our understanding of health and disease. There is widespread recognition of the importance of recruiting and training clinician-scientists. Nevertheless, there are still significant gaps and limitations in how clinician-scientist training programs are structured in Canada.

This paper has presented an overview of existing clinician-scientist training programs in Canada and has outlined the recent decline in clinician-scientist training and retention in research-intensive careers. We show that there are significant benefits in improving clinician-scientist training and provide three recommendations on how the CFMS can work to help strengthen clinician-scientist training in Canada.

The scope of this paper included MD-PhD and CIP trainees. However, the authors acknowledge that MD ‘plus’ programs and experiences exist as an education towards being a physician researcher, and the pathway to becoming a clinician-scientist is not only through MD-PhD and CIP programs. Future work of the CFMS membership should explore how the CFMS can represent, advocate and strengthen the research training elements of all stages of physician education.

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