TRAINEE SECTION

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Clinician Investigator Training in Canada: A Review

Abstract

Purpose: The Royal College of Physicians and Surgeons of Canada undertook a review of its Clinician Investigator Program (CIP), 13 years after launching the program in response to shortages in clinical investigators. The primary study goals were to determine the outcomes, impact, strengths and weaknesses of CIP.

Methods: Focus groups and telephone interviews with current and past program directors (PD) and a detailed survey of current and former trainees were conducted. Thirteen PD and 45% of current and former trainees from 10 CIP participated.

Results: Since 1995, 12 CIP have been accredited and 553 residents have enrolled in CIP, with 194 completing CIP and residency training by 2008. PD recognized CIP as an excellent program that produces highly qualified clinical investigators; important for faculty renewal. Both trainees and PD identified the need to improve CIP funding. Most (84%) CIP trainees did not have prior graduate degrees. Most alumni had completed Masters (58%) or Doctoral (39%) programs during CIP and published on their CIP research (97%). Among alumni who completed CIP and residency, many obtained an academic appointment with protected time for research, with 39% receiving an external career award. Many (60%) alumni reported no drawbacks to CIP and recognized the added values included Royal College recognition, structured training, pursuit of graduate studies, integration of clinical/research training and enhanced mentorship.

Conclusion: Since the program's inception, the number of CIP in Canada has grown. CIP are recognized as important mechanisms for integrating clinical and research training during residency to produce highly qualified clinician investigators.

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In 1995, the Royal College of Physicians and Surgeons of Canada established a new training program, the Clinician Investigator Program (CIP), in response to concerns about increasing shortages of clinical investigators in Canada and the need for formalized, coordinated training in research and specialty or subspecialty medical programs to meet the needs of graduates of MD-PhD programs and others interested in a clinician investigator career [1-5].

Detailed, current information on the CIP can be obtained at <http://royalcollege.ca>. The program provides integrated, rigorous and structured research training that assists the career development of clinician investigators. CIP was introduced as a minimum two year, postgraduate, medical education pathway that can be offered by universities that develop and offer a program that meets Royal College standards of accreditation [2]. CIP requires enrolment in a Royal College-accredited CIP and specialty or subspecialty programs in Canada [2]. When first launched, CIP training pathways included both non-degree and graduate degree (requiring admission to and completion of a Masters or Doctoral degree) options [2]. Graduates receive a Royal College certificate in CIP in addition to their specialty or subspecialty certification and graduate degree (if enrolled in the graduate pathway) [2].

After the ten year anniversary of CIP, the Royal College undertook a review of the program since its inception, as data on CIP have never been published apart from an initial description of the program [2]. The primary objectives of this review were to

1. Describe the program; from inception to present
2. Determine the major outcomes and impacts of the program
3. Determine the strengths and weaknesses of the program, and summarize opinions on how the program could be enhanced
4. Assess funding issues.

Methods

Research Ethics Board approval for this study was obtained from the Ottawa Hospital Research Ethics Board.

The project was overseen by a working group (listed in acknowledgments) that included current and former CIP directors, members of the Royal College CIP Advisory Committee, a representative from Canadian Institutes for Health Research, a recent CIP graduate and Royal College staff.

A combination of qualitative and quantitative methods was used to

- (1) review the Royal College data from 1995 to 2008 on all residents enrolled in CIP, which were confirmed with each program prior to analysis
- (2) survey programs to confirm the sources of funding for the trainees surveyed, including any guaranteed, funded spots
- (3) survey current and former trainees and alumni of CIP, using a web-based questionnaire (shown in Online Supplement 1) (after pilot testing on 25 recent CIP alumni), containing 46 questions (some with mandatory responses). The link to the survey was sent by email to 469 trainees in April 2008. Responses were handled confidentially and were analyzed as an aggregate to assure that individual responses could not be identified
- (4) collect opinions and data by contacting all individuals who were current or former CIP directors, and/or the current or recent President of the Canadian Society for Clinical Investigation (CSCI), using the combination of an in-person focus group and a series of telephone interviews for individuals who could not attend (audio-recorded, then transcribed). Discussion and interview guides (Online Supplement 2) were used to help identify major themes and to ensure that common and important issues were addressed. The collection of information was done by Harris/Decima (Ottawa, ON) between March and June 2008.

Data were analyzed to determine the

- (1) demographics of residents enrolled in the program
- (2) program and trainee funding
- (3) program alumni, including their length of training, degrees obtained, publications, academic appointment and research activities upon completion of training
- (4) residents' perspectives on the value of CIP
- (5) trainee and faculty perspectives on CIP
- (6) recommendations for changes to enhance CIP

Statistical methods

Quantitative elements were analyzed using SPSS (2009) Statistical Package for the Social Sciences Version 17.0 (IBM Corporation, Somers, NY) to describe proportions, medians, means and ranges. For the online survey, data were expressed as a proportion responding to correct for skipped responses. Comments from surveys, focus groups and interviews were provided verbatim for qualitative analysis.

FIGURE 1. Year of CIP training completion for alumni. Data is shown for survey participants and for all alumni of CIP.

Results

Original and current CIP training pathways

CIP was first offered as graduate degree and non-degree options. The non-degree option was discontinued in 2008 when all accredited programs recommended that trainees pursue formalized training in research intensive Masters or Doctoral degree programs, or in a post-doctoral fellowship program if a trainee had a prior graduate degrees. The rationale for this change was that all approved programs were recommending formalized training within a graduate degree program for CIP trainees who did not have prior degrees because they recognized that they could not provide non-degree pathways of similar quality and rigor to trainees without graduate degrees.

Approved pathways, for integrating CIP with clinical specialty or subspecialty training, were changed in 2008 to include

(1) Continuous Training (CT) Pathway: This original pathway involves a minimum of 24 months (longer if doctoral studies are pursued) of continuous, intensive, research training, which can be done at different points during a residency.

(2) Distributive Curriculum Training (DCT) Pathway: This pathway is intended for outstanding residents who have research experience prior to residency and offers coordinated entry into the PGY1 year for both CIP and the specialty program.

(3) Fractionated Training (FT) pathway: This pathway allows for distribution of a minimum of 24 months of re-

search during training, in blocks of three months or longer, with one year of continuous research training. This pathway requires entry into a graduate program, with completion of a thesis or equivalent.

Since 1995, the number of accredited CIP has continued to rise and training is now offered at thirteen (70%) of the Canadian universities with Royal College accredited postgraduate medical education programs. The universities with the oldest CIP (Toronto, McGill, British Columbia) have had the highest number of registrants.

Trainees and length of training

As of 2008, 553 residents (65% males and 35% females) had enrolled in CIP and 256 had completed all of their CIP and clinical residency training. Email addresses were obtained from participating programs (Dalhousie University, Université Laval, McGill University, McMaster University, University of British Columbia, University of Ottawa, University of Toronto and University of Western Ontario) to contact 469 of individuals who were currently enrolled or who had enrolled in CIP (85%). Among those contacted (by an initial email, and a reminder sent two weeks later), 233 agreed to participate in the trainee survey (42% of all who had enrolled, 50% of individuals contacted).

Figure 1 compares the years of completion for all CIP alumni to those who completed the trainee survey. CIP alumni had completed training in many different specialty and subspe-

FIGURE 2. Specialty and subspecialty distribution for CIP, based on Royal College data.

cialty programs (Figure 2), but most commonly in surgery or medicine.

Data from the trainee survey indicated that most ($n=123/211$, 58%) had entered CIP between their 3rd and 4th year of post-graduate medical education. Most ($n=177/210$, 84%) had entered CIP without a prior graduate degree. Data from the alumni surveyed ($n=145$) indicated that the majority ($n=125/145$, 86%) had completed a graduate degree (Masters of Science, $n=72/125$, 58%; Doctoral degree, $n=49/125$, 39% or Masters of Education, $n=4/125$, 3%) during CIP training (Figure 3). The alumni survey data also indicated that on average, alumni took ~7 years to complete all Royal College

TABLE 1. Alumni survey data on the average time to complete training, according to the graduate degree attained.

Description of training	CIP alumni who completed a Ph.D. degree	CIP alumni who completed a Masters' degree
Specialty training	5.8 years	4.1 years
Subspecialty training	2.3 years	2.1 years
CIP training	4.2 years	2.5 years
All training	8.1 years	7.3 years

FIGURE 3. Degrees obtained by CIP alumni, based on trainee survey data.

FIGURE 4. Sources of CIP funding for trainees. The results show data from survey respondents who had completed CIP training.

training, including their specialty and/or subspecialty training and CIP research (minimum 2 years; average for Masters: 2.5; PhD: 4.2) (Table 1). Most (n=105/145, 72%) alumni reported that they had been able to overlap a portion of their CIP and specialty/subspecialty training. There was a low rate of withdrawal from CIP (trainee survey data: n=5/233, 2%; Royal College enrolment data: n=52/553, 10%), which survey participants reported were commonly for personal reasons.

Funding of CIP Training

Data from the trainees surveyed indicated that the sources of funding for the first, second and additional years of CIP training varied (Figure 4) and included universities, hospitals, Ministries of Health (MOH), granting agencies, and trainee clinical earnings. Although provincial MOH fund clinical years of postgraduate medical education in Canada, their support for CIP has varied between years of research training, and between provinces. External awards have contributed more support to later years of CIP training.

Accomplishments of CIP Alumni

Trainee survey data indicated that approximately 67% of CIP alumni (97 out of 145), had attained an academic position, commonly in a clinical department (n=71/97, 73%), and often as an assistant (n=79/97, 81%) or associate (n=12/97, 12%) professor. Among those who had not yet completed CIP, 95% (n=84) anticipated obtaining an academic appointment (including a few who already had an appointment) whereas 7%

(n=6) indicated that they already had an academic position (assistant professor or lecturer).

Most CIP participants (current trainees and alumni combined; n=141/145, 97%) reported publishing a number of journal articles related to their CIP experiences (total: 795 journal articles published by the group; average, per trainee: six publications including three first-authored publications), with most (60%) anticipating that additional publications would result from their CIP research. Among alumni, the number of total and first authored publications related to CIP research (Table 2) was higher for those with a higher academic rank and for those with more elapsed time since completing CIP. The majority of publications related to CIP research were first authored (Table 2).

Most CIP alumni surveyed (n=109/145, 75%) were involved in research, commonly in team (n=71/109, 65%) and/or independent (n=61/109, 56%) projects. Among alumni doing research, the majority (n=87, 80%) were pursuing clinical research, with significant proportions pursuing basic (n=37/109, 34%) or surgical research (n=44/109, 40%). Most alumni (n=73/109, 67%) had a large proportion of time (53%) protected for research and 39% (n=43/109) had obtained external career support. Among alumni, the number of operating grants received after CIP training varied (range: 0-10; Average = 2.17, Median = 1.00). Most (76/103, 74%) were funded by a different agency than the one(s) that had funded their CIP training.

TABLE 2. Number of total and first author publications related to CIP research according to academic rank of CIP alumni. The data was obtained from the trainee survey.

	Academic Rank			
	Associate Professor (n=12)	Assistant Professor (n=78)	Lecturer (n=4)	All (n=94)
Mean elapsed time (years) since CIP completion	8 years (range: 7-10)	4.8 years (range: 1-11)	8.8 years (range: 5-12)	5 years (range: 0-12)
<i>First authored publications related to CIP research</i>				
Total number for the group	125	239	11	375
Median (interquartile range)	5.5 (2-10)	2 (1-4)	2 (1-3)	3 (1-5)
Mean (range), per graduate	10.4 (0-54)	3.1 (0-10)	2.8 (1-6)	4.0 (0-54)
Standard deviation	14.8	2.5	2.4	6.1
<i>All publications related to CIP research</i>				
Total number for the group	192	413	13	618
Median (interquartile range)	8.5 (5-13)	3 (2-6)	1.5 (1-2)	3 (2-7)
Mean (range), per graduate	16.1 (0-65)	4.9 (2-50)	2.2 (0-6)	6.1 (0-65)
Standard deviation	20.8	6.4	2.1	9.7

TABLE 3. Reasons for enrolling in CIP and the value added of CIP, based on responses to the trainee survey.

Reasons for enrolling in CIP	Reasons for enrollment in CIP (% of CIP survey respondents) ^a	Value added of CIP (% of CIP survey respondents) ^b
Recognition by the Royal College	60.9%	72.4%
Allowed to integrate clinical and research training	48.9%	34.5%
Able to obtain additional degree	40.8%	42.1%
Structured research program	39.1%	38.6%
Encouraged by a research supervisor	34.8%	N/A
Enhanced research career mentorship	29.2%	24.8%
Networking with peers interested in research careers	22.7%	28.3%
Required to by a research supervisor	9.0%	N/A
Other	7.3%	7.6%

^a n = 233 enrollees, ^b n = 145 alumni

N/A indicates not applicable (not asked).

Trainee Perspectives on CIP

Trainees surveyed reported that their reasons for enrolling in CIP included: Royal College recognition of training, the structured program of research training, the integration of clinical and research training, the additional degree, encouragement to enroll, and enhanced mentorship, and rarely, a requirement to enroll by their clinical program (Table 3). CIP alumni perceived that the added values of CIP training included Royal College recognition, an additional degree, integrated clinical and research training, structured program of research training and networking opportunities (Table 3).

Among trainees surveyed (n=233), the majority (60%) did not identify any drawbacks to CIP training; however, 42% indicated that obtaining funding for CIP training was a stressful concern and 31% reported that the delayed time to completion of training was a drawback of CIP training. A few reported other drawbacks, such as income reduction, loss of clinical skills, increased workload and stress. The most common suggestion for improvement to CIP training (reported by 47% of trainees) was to increase the secured funding for trainees.

Faculty Perspectives on CIP

CIP faculty input was obtained from 13 individuals (six from focus groups, remainder from interviews). These individuals believed that CIPs have important value and that these programs have successfully fulfilled the career track needs of CIP trainees, with positive impacts on trainee research and academic career successes.

CIP faculty indicated that there is a need to gather (by rigorous research methods) more information on the careers of former trainees, including the percentage of their time that is

devoted to research and their publication and research funding records. Many agreed that CIP is a program of excellence that produces highly qualified clinical investigators; however, the group identified a need for progress in addressing the lack of resources faced by many programs, including the lack of consistent, protected funding for trainees from MOH.

CIP faculty had concerns about time constraints on trainees and the need to protect trainee time for research. They also had concerns about the difficulties of allowing research to be part of clinical residency training. The group recognized the need for more communication between universities, for both CIP trainees and CIP directors.

Many faculty had similar views of what the CIP mandate is or should be, namely a valuable training pathway (based on a Royal College framework) that stimulates and creates training paths for individuals to become clinician investigators and positively impacts on successes in research, which is important for increasing and renewing the pool of clinician investigators in academic centers.

Many faculty had common views on the roles of CIP directors, as important mentors, supporters and coordinators of clinician investigator training within their university who provide trainees with support and protection to enable them to acquire critical skill sets as future investigators.

Many faculty indicated that an increased emphasis on resources and funding is critical to the success of CIP. Many recognized that CIP training needs to be flexible for optimal support. Most faculty defined a successful CIP by the quality of trainees and their career paths and later successes in pursuing careers in academic medicine, fostered by an enthusiastic approach to providing good experiences and supports in order for trainees to acquire the broad skill sets needed for a future ca-

reer as a clinician investigator. Items that they identified as key to CIP success included

- (1) financial and moral support from the Dean's office and Postgraduate Medical Education
- (2) ability to offer longitudinal support and mentorship to trainees throughout residency - not just during CIP research years
- (3) development of training pathways that provide research links to trainees from medical school to residency and beyond, and
- (4) trainees who will eventually work as Clinician Investigators.

The majority of CIP directors reported spending approximately 10-20% of their time on CIP over the course of a year but much more time when establishing the program. Program directors reported varying levels of supports from university departments, as some departments were not interested whereas others were very supportive and helped find funding for residents in CIP. The administrative support for CIP varied considerably, with funded administrative and secretarial support ranging from unacceptable to full time support positions (reported average: approximately three days' worth of administrative support/week). Stipends varied, and most program directors reported that these were increasing and becoming more reasonable. Several program directors reported a lack of protected time to run CIP.

Faculty indicated that an important strength of CIP was its structured approach to training, which provides trainees with important mentorship by established faculty investigators, and exposure to a culture in which research and clinical care are synonymous. Additional strengths identified included the quality of the trainees and administrators involved in CIP (including the dedicated and talented program directors and research faculty and supportive Postgraduate Medical Education offices), the recognition that trainees received for completing CIP, and CIP flexibility in the timing and integration of research into clinical programs.

Uniformly, funding was identified by faculty as a CIP weakness. Participants had concerns about the lack of secure and sustainable salary support for trainees (particularly at commencement of their research training, confounded by rising trainee debt loads) and the amount of effort that was required to obtain "patchwork" funding. Some "resource-rich" programs and departments were supporting many trainees, sometimes from faculty or trainee billings. Overall, funding was described as inadequate and a deterrent to CIP entry. Many programs required trainees to apply for external awards, to help leverage funding for their training. A few programs

received provincial funding for CIP trainee salaries and program directors recommended that all provinces provide funded spots for CIP through the MOH, similar to how other residency programs are supported, to guarantee training opportunities and increase transparency.

Faculty identified some additional CIP weaknesses, including deficiencies in the research culture and mentors within some clinical residency programs, hospitals, departments and administrators. They recognized that CIP does not guarantee future success, which may require additional training and experience, sometimes outside of Canada. Increased time demands on clinical training leads to increased pressures on CIP. Some program directors felt it was difficult to provide a suitable core curriculum to make trainees feel part of an integrated program.

Faculty discussion on opportunities for improvement in CIP touched on partnerships with other organizations. Strengthening of CIP and Royal College ties were recognized as important, with potential to better promote CIP curriculum development across the country and explore joint opportunities. Faculty felt it was important for the Royal College to collaborate with universities to find solutions to CIP funding problems. Opportunities for improvement and CIP development included better supports from universities for program directors to meet with other CIP directors. Potential opportunities for collaborations were discussed, including the Strategic Training Initiative in Health Research, introduced by Canadian Institutes of Health Research, given some commonalities in expectations and curriculum. Potential partnerships with charities (which have never provided resident funding in the past) were raised.

Discussion

This is the first report on CIP since this training pathway was established by the Royal College in 1997 [2]. At present, CIPs have been established by most universities that offer postgraduate medical education in Canada. A major finding of our study is that CIPs are valued by trainees and faculty as a pathway for training clinician investigators. These programs have been successful in attracting, and graduating, clinician investigators who publish research papers, attain academic appointments and pursue independent and team research projects, often supported by external career awards. The extra years of CIP training do prolong the time to completion of residency, although the majority of trainees who we surveyed did not perceive this as a drawback to the CIP training. On average, it takes 8 years for most individuals to complete CIP and specialty/subspecialty training, with the majority of CIP trainees obtaining an M.Sc., Ph.D. or M.Ed. degree from their research-

intensive studies. CIP alumni engage in a broad spectrum of health research, with the majority focusing on clinical research. This is interesting, as other clinician investigator training pathways (e.g., M.D.-Ph.D. programs) are noted for producing researchers that primarily pursue basic health research [6]. An important finding of our study was that CIP trainees and faculty were very positive about the value of CIP, and the opportunities provided by this training pathway, including the structured and enhanced mentorship for developing future clinician scientists. Trainees also valued the Royal College recognition of research training. Nonetheless, difficulties have been encountered in supporting CIP trainees during their research years, as trainees are commonly required to obtain funding from sources other than the agencies (MOH) that support their clinical specialty/subspecialty training. Funding has previously been identified as a challenge to clinician investigator training in other studies, with loss of income viewed as a disincentive [8,13] even though it was not identified as a major deterrent in our study. Funding will be an important issue to address to ensure the success and sustainability of CIP - both trainees and faculty recognized the lack of secured funding for the additional years of training as the major weakness of CIP. It will also be important to work collaboratively to coordinate CIP with other Royal College pathways, in order to ensure that research and clinical training plans are optimized.

In the future, it may be worthwhile to further evaluate the careers of former CIP trainees, to determine how CIP influences engagement in different types of research (including patient-oriented research) and research successes; including long term, academic success, research funding and publication records. CIP has the advantage of meeting the needs of graduates of M.D.-Ph.D. programs (who pursue a postdoctoral fellowship during CIP) and “late bloomers”, without prior graduate degrees, who decide to pursue a research career later in clinical training. The program incorporates many recommendations for training future clinician investigators; including integrating clinical and research training, protecting time for focused research training, formalized goals and objectives, enhanced mentorship, peer to peer interactions, a goals and objectives focused curriculum, designed to complement scholarly research and professional skill development with programming for broad skill development (i.e., as a collaborator, communicator, manager and advocate) as preparation for an academic, research-focused career that may include patient-oriented or basic health research, promotion of skills that lead to research publication and formalized processes for evaluation [7-14].

A strength of our study was the participation of all programs and current and former CIP directors. Less than half of

the individuals who had enrolled in CIP participated (42% of all enrollees, 50% of individuals contacted). A further drawback was that there was no obvious control group for comparison of accomplishments. Additionally, faculty perspectives on CIP were provided by a group who had been very involved in the program, which could have biased some of the findings. Although the many of the surveyed trainees were recent alumni, many had successfully obtained a research-intensive, academic appointment, and a significant number were supported by external awards. Not surprisingly, more publications were associated with a higher academic rank among CIP alumni, given that publications influence academic promotion and additional academic experiences provide opportunities to publish more research. Interestingly, research experiences leading to publications during medical training have been associated with an increased likelihood of pursuing an academic career [8, 10]. Additional research is needed to determine the relative contributions to CIP and other programs (e.g., M.D.-Ph.D. training [6], which would be complemented by subsequent CIP training or non-CIP fellowships) to producing clinician investigators in Canada.

Our study has provided important, novel information on what has happened to CIP since their introduction. The growing numbers of CIP programs and trainees, and the perspectives shared by trainees and faculty, indicate that the structured research training that the Royal College accredited CIP provides, and the integration of clinical and research training, has a valued role in producing successful clinician investigators.

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