Funding HIV/AIDS research training in Canada:

What do we know about outcomes?

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Michelle Campbell & Mark Bisby

campbell.michelle@sympatico.ca

Executive Summary

Introduction

The Canadian Association for HIV Research (CAHR) identified a need to examine the broad HIV/AIDS research funding landscape, and brought together the Canadian Institutes of Health Research (CIHR); the CIHR Canadian HIV Trials Network (CTN); the CHVI Research and Development Alliance Coordinating Office (ACO); the Canadian Foundation for AIDS Research (CANFAR); and the Ontario HIV Treatment Network (OHTN). Collectively, they defined the goal of this work: to identify the best ways to support the development of Canada's HIV/AIDS research capacity.

Today, diverse funding models seek to create different kinds of training environments – and different kinds of trainees. Thus, rather than asking "what is the best way to support training?" the key question becomes "What does each training mechanism best achieve, for whom, under what circumstances?"

The health research career path

Once upon a time – only a generation ago – the majority of PhDs desired, trained for, and achieved, an academic career. As recently as the 1970s, most health research trainees could expect to hold a faculty position in their late 20s, and post-doctoral fellowships were a special privilege of a few rising superstars, to provide protected time and mentorship to jump-start an independent research career.

Since then, the supply of PhDs has vastly increased but the number of faculty positions stayed the same, and yet any other career path is deemed second rate. As a result, 90% of PhD students still identify an academic career as their goal, even though only 10-20% of them are likely to achieve one – and an increasingly soft-funded one at that. The few that make it to independent investigator face low funding success rates, high drop-out rates – especially for women – and a deeply risk-averse funding system that discourages pursuit of all but the heaviest-trodden research pathways. Without radical change, the U.S. National Research Council concludes that these problems will become "the root causes of the U.S. fall from pre-eminence in biomedical science."

Even while Canada's biotech industry reports a hiring shortage, Canada's life science PhDs can expect higher unemployment and lower pay, and a long wait for the "adult" status, income, and stability that comes with being an employed professional. All in all, the data suggest that we are training life scientists with limited regard for the career options available to them, or the skills they need to succeed.

The HIV/AIDS funding landscape

The HIV/AIDS funding landscape as a whole is dominated by the Canadian Institutes of Health Research (CIHR), which provides about 75% of the current $60M annual funding, and continues to grow at a rate of about $2M per year. The Ontario HIV Treatment Network (OHTN), the other substantive Canadian player, provides some 8% of current funding. Over the last 15 years, the Canada Research Chairs, the Canada Foundation for Innovation and the Global Health Research Initiative have all made substantive investments in HIV/AIDS. Nonetheless, greater funding overall has come from the U.S., through the Bill and Melinda Gates Foundation and the National Institutes of Health (the latter about 10% of the total).

Due to the prominent role played by the NIH, Gates and CFI, more than 80% of Canada's HIV/AIDS research is invested in grants, though less at CIHR (70%), where almost 30% now goes to salary and training awards, knowledge translation and research facilitation. Over time, about 40-50% of CIHR's funding has been through the CIHR HIV/AIDS Research Initiative, the rest through open competitions and other initiatives. While CIHR funding to the biomedical theme has more than tripled, the theme of social, cultural, environmental and population health research has grown faster, to comprise about 30% of current CIHR funding. Clinical research has kept pace, but not expanded, and stayed at about 20% of CIHR's HIV/AIDS funding; however 90% of that comes from *strategic*, not open, competitions. Spending on vaccine research related to HIV/AIDS has increased almost four-fold between 1999 and today, with considerable growth predating the Canadian HIV Vaccine Initiative (CHVI).

Compared to grants, a much higher proportion of CIHR's funding to training and career awards come through open competition, due to the growth of new federal award programs. Emerging areas such as community-based research, however, are far more dependent on strategic competitions not just for training, but also for follow-on operating grants when those trainees become new investigators.

Capacity, productivity and impact

There has been huge growth in HIV/AIDS research capacity in Canada from 2001-08, both in the number of grantees (3x larger) and in the number of publishing authors (2.5 larger). The largest growth has been in the health services/ population health stream, and in community-based research.

Canada is producing about twice as many HIV/AIDS publications as it did in 2000, and still growing, though more slowly than before. Canada's share of this field is now consistent with its overall share of world health research (4%), and Canadian investigators are now on average about 65% more productive than a decade ago. The quality of Canadian HIV/AIDS publications is well above world average, with the second-highest citation rate in 2006-08 period, though others have jumped ahead since.

Publications have grown most in health services and population health, where Canada's numbers and share of world publications more than quadrupled since 1996. Furthermore, Canada's community-based research now constitutes 8% of world's output, almost twice that of HIV/AIDS as a whole or Canadian health research in general. A very positive trend continues to be seen in publications related to HIV/AIDS and Aboriginal health, which are increasing substantively in both quantity and citation rates.

Mechanisms to support training

The value of supporting research training has long seemed so obvious that funding mechanisms weren't usually developed with explicitly stated objectives; it is difficult, in consequence, to evaluate whether they are achieving their intended purpose. For individual awards programs, when the assumed objectives have been made explicit and evaluated, the programs often fail to achieve them – though other benefits may be identified instead. New support mechanisms are typically assessed against old metrics, leaving unknown whether they are in fact creating different kinds of trainees. Overall, there is little data on training outcomes in Canada, and even less on the outcomes that matter most.

Given the paucity of data, the emphasis in this report is on what different funding approaches can *ideally* achieve, not necessarily what they always *do* achieve. Looking at six broad categories of training support mechanisms, the report seeks to identify the structural strengths and challenges of the models, best potential outcomes, and the circumstances under which each can be most effective.

A. Individual awards (direct support)
B. Individual awards with extra supports ("Awards+")
C. Training programs (such as CIHR's STIHRs)
D. Teams, networks, centres and other large groups
E. Grant-funded training (indirect support)
F. Other supports and resources (networking, workshops, etc)

"Bundled" supports combine funding and various other resources

Prestige

Individual awards won through national competition are valued foremost for their cachet, seen as giving the trainee an advantage in getting a preferred supervisor or job. Previous CIHR funding, including awards, is also a major predictor of success in obtaining CIHR grants. It is worth noting that it is the "gold stamp" of national peer review, as opposed to the actual *funding*, that confers this benefit.

The increasing use of institutional pre-selection or review (e.g. Canada Graduate Scholarships, Vanier awards, Canada Research Chairs) may be somewhat eroding the unique prestige of awards, as is the considerable overlap between award holders and STIHR-funded trainees. However, although evaluation shows no substantive differences in their incoming qualifications or research outputs, individual training awards are still seen by trainees and supervisors as providing a significant competitive advantage.

Independence and control

Individual awards typically provide their holders with the greatest independence and control. They are the only structure which enables full international mobility (though with increasing rarity). Equipped with their own funding, awardees are most clearly distinguished from the investigator's research staff, giving them greater leverage to control their time and focus on their own research. However, in non-lab based disciplines trainees often work separately from their supervisor; too much independence can sometimes turn into isolation, limited development of research skills, low support and mentoring.

While larger research environments – such as training programs or teams - may offer the trainee less control, they can offer more choice and flexibility. For example, trainees may be more able to choose where to focus their time among a range of mentors, a variety of projects, and multiple learning opportunities, which also makes it easier to address a sub-optimal trainee-supervisor combination. Team funding is usually more flexible than regular grants; some teams have provided operating funds to senior trainees to enhance their project and/ or transition towards independent researcher.

At the opposite end of the spectrum from individual awards, indirect funding creates an employment relationship in lieu of a trainee-mentor relationship. This situation becomes increasingly problematic with the more senior the trainee. The U.S. National Research Council has decreed indirect funding to be disastrous for post-docs, and has called for major changes at NIH to give post-docs control over their funding and the ability to pursue their own research interests within a robust mentored environment. The post-doc period should be short, and explicitly – and accountably – directed to increasing the independent functioning and capacity of the post doc as they transition to independent investigator.

Access and equity

Individual awards have usually offered the highest levels of accessibility and equity – everyone is equally aware of and able to access a well-advertised national or regional competition. The award advantage may, however, be seen as somewhat eroded by the advent of CGS awards and the shift towards

institutional review. The Canada Research Chair experience highlights the importance of transparent local selection processes to ensure perception of fairness, especially for more senior awards.

STIHRs, teams and indirect support, on the other hand, can present access challenges: these modes of funding may advantage local candidates, who are more likely to be aware of opportunities, be known to program leaders, and be in place to apply/ interview. A clearinghouse of training opportunities, or better yet, a shared single-window entry point, would go a long way towards improving equity of access.

Although many individual awards are "targeted", most are open to any kind of candidate, to address any topic, and are available consistently ever year. Trainees seeking support through STIHRs, teams and indirect support, in contrast, must find a program or supervisor that happens to match their interests, and happens to have an opening that matches their timeline, and happens to have funds available of the needed duration. Any grant-funded trainee is subject to failed renewal: indirect-supported trainees are the most likely to find themselves partially funded, or scrambling mid-way through to find new funding.

Financial support

The Canada Graduate Scholarships (CGS) were created to increase the number of graduate and doctoral trainees, by addressing the financial barriers which were assumed to have negative impact on training numbers, speed, completion and retention. However, the CGS were found to have little impact on any of these factors. Although the awards had little impact on either income or debt levels, they did reduce the amount of paid work, and of less relevant work, especially with larger stipends. Overall, the system seems to have found an equilibrium which kept all trainees at a fairly similar compensation level, regardless of their sources (at least up until the advent of the much more lucrative Vanier awards).

Few trainees are supported by a single source throughout their training: awards typically only cover about half the years most require to complete a degree, for instance. Other years will be supported by teaching assistant jobs, other non-federal awards, indirect funding, institutional support, jobs outside academia, loans and other sources. It is thus perhaps not so surprising that no one funding mechanism has overwhelming impact on trainees' complex financial support system.

Both trainees and mentors value the funding flexibility of STIHR and team funds, which allow them to adjust funding use to specific trainee need: for example, to spread funds out over more students (when students bring in their own individual funding), fund part-time studies, or top up funding for those with more income to lose (the latter two are especially important for clinicians seeking research training).

Mentoring and training environment

A great mentor will undoubtedly manage to be great no matter how their trainees are funded. Nonetheless, some mechanisms are designed to encourage and support the development of the best training environments, while others are designed to fulfill different goals entirely.

Indirect funding provides the least incentive, impetus or resources towards building or strengthening the training environment, while training programs provide the most. CIHR's individual awards do assess the supervisor, but provide them no support for training, nor are they held accountable for the training provided. Some team funding mechanisms explicitly target and resource capacity building. Awards+ models may be not so much targeted at improving the training environment, as in providing, from an external source, those elements it might be missing.

Interview data suggests that both trainees and mentors have found that training programs, teams and some Awards+ approaches (such as CTN Fellowships) can offer much more effective and desirable training environments than traditional mechanisms. These approaches offer richer experiences, in both breadth and depth: both trainees and supervisors describe trainees as being ahead of, and more competitive than, their award- and indirect-funded peers.

Teams can be valued "incubators" for new investigators, with resources, infrastructure, and access to other's research and wisdom that can "kick-start" a new investigator's career and grant success. However, for team approaches to be fully effective, promotion criteria needs to be modernized to embrace the larger and more complex composition of modern research.

A challenge with investing in creation and enhancement of training environments is that these need to be long term investments, but often aren't. Programmatic approaches tend to involve the creation of extensive teams, infrastructure, new curricula and delivery mechanisms; they often involve multiple institutions as well as external partnerships. They typically take several years to get fully- functional, and another couple to reach their full potential – at which point the funding is done.

Readiness and retention

If research training is being undertaken as preparation for future employment – rather than training for its own sake – support of training environments (as opposed to direct support of trainees) makes it possible to incorporate the wider range of skills, mentors, research environments, equipment and practical, hands-on experience which trainees need to obtain, and succeed in their future jobs.

Only a small portion of Doctoral trainees, and even fewer Masters, continue on in HIV/AIDS studies. "Bundled" approaches, however, tend to engage the trainee in a deeper way with a community of practice; data is needed to assess anecdotal evidence that trainees who thus engage in a community of practice are more likely to stay in that community, in addition to being better prepared to succeed.

New Investigators

The greatest challenge for new investigators is getting and renewing a first grant. There is a widespread belief that the low success rates of new investigators stems from budgetary pressures at CIHR - and yet a doubling of the NIH budget between 1998–2003 did not improve the success of new investigators. The answer needs to lie somewhere other than in the grants budget. In Canada, evaluators of CIHR's operating grants program (OGP) report hearing many concerns about new investigator success rates, causing CIHR to worry about this "misunderstanding of the OGP's role as a mechanism for supporting young researchers" - given that it has no such mandate.

These findings underscore the importance of mechanisms which help young investigators increase their success in grant competitions. While funders have traditionally seen salary support as the key to protected time and therefore success, evaluation suggests awards don't really increase time devoted to research. The value of salary awards appears to be primarily to institutional budgets, with limited impact on the actual award holders. New investigators themselves put higher value on other kinds of supports, especially networking as well as starter/ bridge grants that help them break into or stay in the granting system. They also value those teams which address these elements in an integrated way.

Conclusions

Canada's HIV/AIDS research capacity has experienced phenomenal growth in both scale and quality over the last decade. Our ability to make use of that capacity has not, however, kept up. The assessment of HIV/AIDS training outcomes identified two core challenges in research training and career development in Canada. First, most post-docs and new investigators find it extremely difficult to find academic positions, especially tenure-track ones. Second, the vast majority of more junior trainees, including award holders, do not go on to further HIV/AIDS training, let alone careers in Canadian academia. It would be timely for HIV/AIDS research funders to shift their emphasis from producing more trainees, to producing better-equipped trainees well-connected to the career paths they will pursue.

Trainees and their supervisors have differing visions of what makes for a quality training experience. While supervisors emphasize depth and core research skills, trainees increasingly emphasize the breadth of experience that gets them their next position, job or funding. Evidence is with the trainees: the key elements to achieve good training outcomes include networking, professional skills, quality and varied mentorship and training environments, and for more senior trainees, independent research funding.

In consequence, rather than funding individuals in disconnect from their research environment, funders could improve outcomes by creating high quality training environments, and supporting individuals within them. **Training program grants and team funding** can, with appropriate design and accountability, be highly effective; a well-lauded model is OHTN's Universities Without Walls. Used together, they can be even better, for example, when a groups of teams collaborates with a STIHR to provide shared access to core training, networking, summer institutes, curricula, etc.

Funders can create **bundled awards**, for example using CTN's highly-successful Fellowships model, which maintain the advantages of individual awards but provide additional supports and resources which address key gaps in individual award support.

Supports and resources for HIV/AIDS trainees and new investigators: Some examples

Networking and skills development - Identify trainees' biggest barriers and shared needs; develop ongoing events and opportunities to develop skills, and network with peers and researchers, including:

- Participation in key conferences, with dedicated sessions plus highlight them to participants at large
- Build tools and resources including training modules and resources, on-line courses, webinars
- Use social media for on-going discussion, to create a single window to training/jobs opportunities and resources, and support roles as both mentees and increasingly mentors

Targeted small grants

- Visit grants to enable experience of a range of mentors, environments, equipment, infrastructure, data, partners and communities
- Catalyst grants for post-docs and new investigators to build track record/ increase independence

Summer institutes

- Large-scale, intensive annual events, integrated with other networking and training supports;

Training programs and teams

- Build quality training environments well-connected to broader research and mentorship environments and career opportunities; protected research funds could support PDF/ NI pilots and higher-risk research; and teams provide access to other research projects, data, and infrastructure

Finally, funders can identify key gaps in current training environments, and **create resources and supports** which fill the gaps for Canadian HIV/AIDS trainees as a whole. Whether provided ad hoc or as part of bundled awards, training programs or teams, funders could focus particularly on training and resources which address barriers to employment of new doctoral graduates, and post-doc/ new investigator transition to independence.