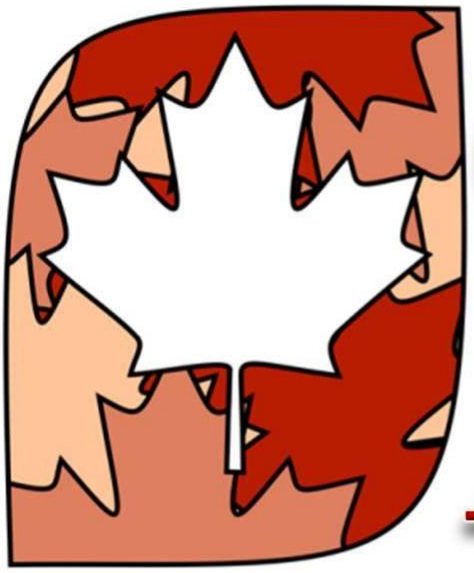

CAPS
ACSP

Canadian Association of Postdoctoral Scholars
Association Canadienne des Stagiaires Post-doctoraux

CAPS Official Report to the Advisory Panel for Canada's Fundamental Science Review

Fall 2016

Canadian Association of Postdoctoral Scholars
Association Canadienne des Stagiaires Post-doctoraux

Tuesday, October 5th, 2016

RE: Canada's Fundamental Science Review

Dear members of the Advisory Panel,

The Canadian Association of Postdoctoral Scholars (CAPS) is a national organization that represents the interests of postdoctoral scholars / fellows / associates ('postdocs') working in Canada, as well as Canadian postdocs working abroad. The following report represents CAPS official response to the request from Dr. David Naylor, Chair of the Advisory Panel, for input from our organization with respect to Canada's Fundamental Science Review. This report incorporates data from thousands of postdocs who responded to the three National Postdoc Surveys that CAPS (in partnership with other agencies) conducted in 2009 (Stanford et al., 2009), 2013 (Mitchell et al., 2013), and 2016 (not yet publicly released). The recommendations in this report are based on input from current and past postdocs working in Canada and abroad, and especially current and former members of the CAPS Executive. This report focuses primarily on identifying the major challenges that face postdocs training in the current Canadian research ecosystem and providing potential solutions to address those issues. Copies of our 2009 and 2013 survey reports accompanied this document, but the official report from our 2016 survey will not be released to the public on our website (http://www.caps-acsp.ca/en/) until this November, so we ask that the committee treat this report, as strictly confidential.

We are thankful for the opportunity to contribute to this review and we hope that our input is helpful in shaping the research/training system that Canada needs for the future.

Writing on behalf of the thousands of postdocs who answered our surveys, sincerely,

Joe Sparling, PhD

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1 Review and Analysis of Data from CAPS' Surveys

1.1 Overview of Surveys and Demographics of Respondents

Respondents on all three surveys included postdocs working in Canada as well as Canadian postdocs working abroad. The 2016 survey also included "past postdocs" (i.e., people whose final postdoctoral contract ended in the last 4 years) whose responses were analyzed separately from those of current postdocs.

	2009	2013	2016
No. of respondents	1,192	1,830	2,109
Average age (yrs)	58% between 30-35	34	34
Gender	56% male 44% female	53% male 47% female	51% male 47% female
Nationality	44% Canadian 17% Permanent residents 39% Work permit	47% Canadian 15% Permanent residents 38% Work permit	57% Canadian 13% Permanent residents 29% Work permit
Canadians working abroad	1%	3%	12%
Partner	48%	69%	60%
Dependents	29%	35%	30%
Multiple dependents	13% (43% of parents)	16% (46% of parents)	15% (50% of parents)

Table 1 – Overview of surveys and respondent profiles

Key points and demographics from Table 1:

- Thousands of postdocs responded to our surveys each year.
- The average age of respondents remained steady over that period at ~34 years.
- The proportion of male and female postdocs appears be equalling-out over time.
- The number of respondents who are Canadian citizens has increased over time (from 44% in 2009 to 57% in 2016), whereas the number of permanent residents (17% in 2009 and 13% in 2016) and international postdocs on work permits (39% in 2009 and 29% in 2016) decreased in that period.
- The number of Canadian postdocs working abroad increased by 11% from 2009 to 2016.
- The number of respondents with a partner went up over time, reaching ≥60% in 2013 and 2016.
- Across all 3 surveys, ~1/3 of postdocs had dependent children and the proportion with 2 or more children has increased over time to 50% in 2016.

Although the average age of postdocs appears to have remained stable from 2009 to 2016, a closer look at our survey data suggests that the postdoc population is slowly aging (Fig. 1), as the proportion of postdocs under 30 and between 30 and 34 years (35 years in 2009 survey) of age has declined over time, whereas the proportion of postdocs over 35 years (36 years in 2009 survey) of age has increased over time. This trend may at least partly be due to longer training times, as the proportion of respondents who completed their highest degree >3 years or >5 years prior to each survey has increased from 25% and 6% (respectively) in 2009 to 44% and 17% (respectively) in 2016 (Table 2).

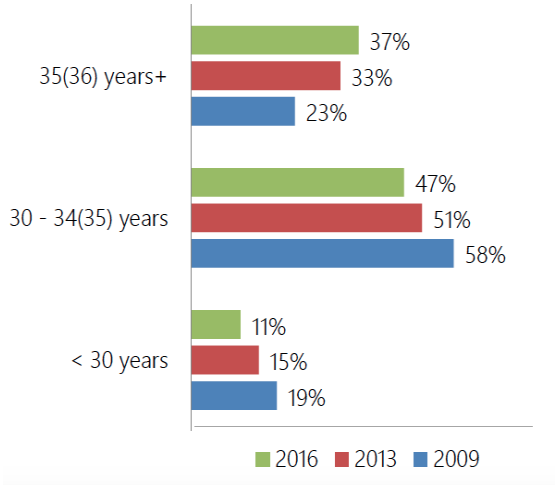

Figure 1 – Aging of the Canadian postdoc population. Proportion of respondents that fall into different age categories from 2009, 2013, and 2016 surveys. N.B.: The 2009 survey used slightly different age ranges for reporting (values in brackets).

Time since completion of highest degree	2009	2013	2016
>3 years	25%	29%	44%
>5 years	6%	9%	17%

Table 2 – Time since completion of highest degree (>3 years or >5 years) by survey year.

Challenges identified:

- ***Decline in recruitment / retention of international postdocs***
- ***Aging of the postdoc population***
- ***Increasing length of postdoctoral training period***

1.2 Employment status and access to social support and other benefits

Despite the rise in postdoc unions in Ontario and Quebec over the last decade, the majority of postdocs working in Canada today are not classified as employees by the institutions where they conduct research. Indeed, based on the type of tax form received by respondents working as postdocs in Canada in 2016 (ignoring those who received multiple tax forms including a T4, which typically indicates that the T4 reports "other income" from benefits, rather than salary), **we estimate that only 30% of postdocs are classed as employees today**, whereas 36% self-reported that status in 2013. A decline in employee classification among postdocs between 2013 to 2016 seems counter-intuitive given that a handful of institutions unionized in that period, but it is important to point out that externally funded postdocs (e.g., Tri-council award holders) are often excluded from unions because their salaries are not paid by the institutions where they work, so they are not considered employees. In addition, some universities in Canada changed their policies during that period to specifically eliminate the option of employee-style contracts for postdocs; a move that many postdocs interpret as an attempt to minimize the threat of unionization. Employment status has been a major point of contention/frustration among respondents in each of our surveys, and the proportion of postdocs who preferred to be classed as employees increased over time, from 62% in 2009 to 76% in 2013. Although that question was not directly addressed in the 2016 survey, the desire for employee status remained high among 2016 respondents, as indicated by the fact that 76% believed that "Lobbying for access to EI/CPP" should be an 'essential'/'high' priority for CAPS.

The lack of employee status for most postdocs results in their exclusion from Employment Insurance (EI) and the Canada Pension Plan (CPP), and often excludes them from other employee benefit plans (e.g., health / dental insurance, drug plans, etc.) that are commonly provided to university employees. According to our 2016 data, a large number of postdocs working in Canada lack most basic benefits, as depicted in Figure 2 (left

panel). Note the large number of postdocs who were unaware of the details of their own benefits plans in that figure ('Don't Know' responses; green), which clearly indicates the need for improved communication of benefits information to postdocs. EI, retirement plan, dental insurance, CPP, extended health benefits, and paid parental leave topped the list of benefits desired among postdocs who don't have access or don't know if they have access on the 2016 survey (Fig. 2; left panel; Note: respondents could only choose the 3 benefits they most desired). The lack of access to paid parental leave is particularly troubling for female postdocs who have no choice but to take time off if they become pregnant, and for those planning to start a family.

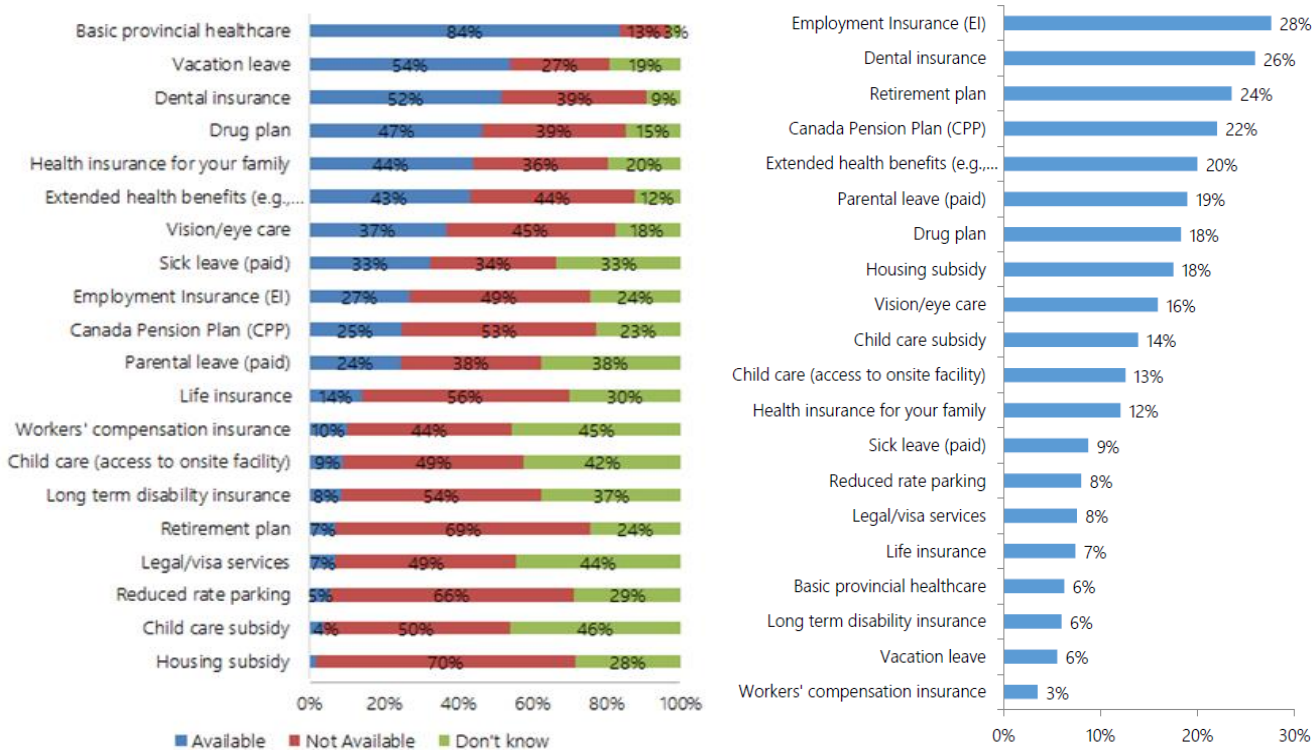

Figure 2 – Benefits available to postdocs (left) and top benefits desired among postdocs with access or who don't know if they have access (right); 2016 survey data.

The majority of postdocs did not have access to a pension plan in 2016. We estimate that only ~30% of postdocs had access to CPP (based on tax form data) and only 7% of postdocs reported having access to another retirement plan through their institution; although it should be noted that 24% were unsure about their access (Fig. 2). As a result, the average postdoc working in Canada gives up a year of CPP contributions for every year of training, and they are left with only single-payer private options without the added benefit of pensions that include employer contributions. This is likely to have a serious impact on CPP benefits during retirement, as only ~7.5 of a person's lowest-contributing years can be excluded from the final retirement benefits calculation, and postdocs are likely to have already accumulated quite a few low-contribution years during their lengthy postsecondary education. In addition, the low average salary of postdocs working in Canada ($46,600 in 2016; see below) will further reduce savings opportunities, as the typical Canadian saves ~4% of their income each year, which only translates into ~$1,900/year on average for this group. Setting aside even that much money can be difficult for many postdocs, and this is particularly true for the 15% of

respondents that had multiple children on the 2016 survey. For a growing number of postdocs (37% in 2016), this decrease in retirement savings occurs during the start of the "prime earning / saving years of life" (35-65 years of age; Vaillancourt et al., 2015), and this group is likely to struggle the most to save adequately for retirement.

In addition to the negative effects noted above, it should be mentioned that the lack of employee status is particularly concerning to international postdocs, as the classification of postdocs as 'trainees' or students prevents their employment from being recognized as 'skilled work experience' for the purposes of gaining permanent residence en route to potential citizenship. This may be a contributing factor in the decline in the number of international PhDs seeking postdoctoral training in Canada today (Table 1).

Challenges identified:

- ***Lack of employee status***
- ***Lack of access to EI and CPP***
- ***Lack of access to paid parental leave***
- ***Lack of access to other benefits***
- ***Lack of access to employee pension plans***

1.3 Hours worked and compensation

Postdocs work long hours compared to most Canadians. The average number of hours worked per week is 39.3 for full-time employees over 25 years of age in Canada (Statistics Canada; January to August 2016 labour force data). In contrast, the vast majority of postdocs work >40 hrs/wk (83%), and a substantial proportion work even more than that (39% >50 hrs/wk and 15% >60 hrs/wk; Fig. 3). In addition, it should be noted that about a quarter of postdocs (27%) do so without access to paid vacation leave (Fig. 2).

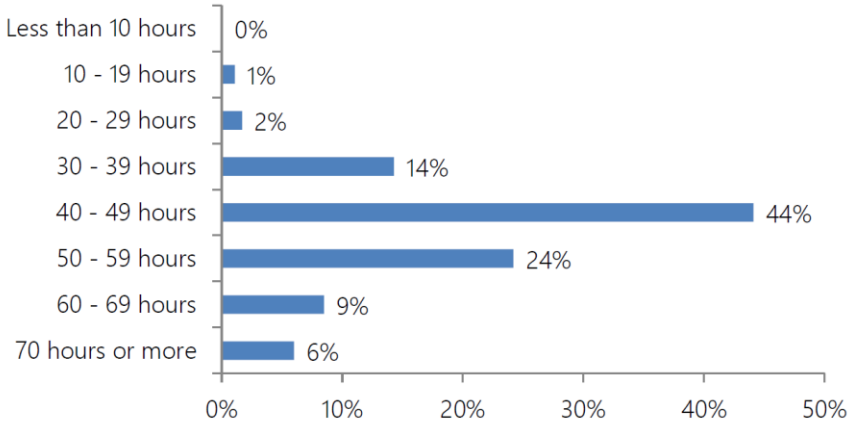

Figure 3 – Average hours worked per week by postdocs (2016 survey)

Although they work hours similar to other highly skilled and trained professionals, on average postdocs receive relatively little compensation compared to those other groups. The average annual salary data from our three surveys is presented in Table 3. At present the average estimated salary among postdocs currently working in Canada is $46,600/year. Adjusting to 2016 dollars to correct for inflation, we found that the average salary for a postdoc working in Canada in 2016 only effectively increased by $1,800 since 2009 and $600 since 2013. The

majority of the change in salary appears to be due to fewer postdocs in Canada making <$45,000/year, but that group still accounts for 52% of respondents in 2016. On average, postdocs whose salaries are covered by foreign agencies and those working abroad made $8,900 and $7,400 (respectively) more per year than postdocs working in Canada with salary support from a Canadian agency/institution. In addition, funding agencies in other countries, such as the US (Kirschstein, 2015) and the UK (NC3R, 2016) use a commensurate salary system where salary increases with years of experience. The Canadian research/training system does not use a commensurate approach to salary, and thus fails to acknowledge the value of the training and experience of its postdocs.

From a purely financial perspective, Canadian PhDs are incentivised to take on postdoctoral positions in other countries because our system fails to provide competitive salaries that are adjusted according to work experience. This may help to explain why the number of Canadian postdocs working abroad jumped to 12% in our most recent survey (2016), up by 9% from 2013 and 11% from 2009 (Table 1).

	2009	**2013**	**2016**
Average annual income	**Canadian dollars**		
Postdocs working in Canada (unadjusted)	$40,000 (79% <$45,000)	$44,000 (63% < $45,000)	$46,600 (52% <$45,000)
Postdocs working in Canada (adjusted to 2016 $)	$44,800	$46,000	$46,600
Foreign funded postdocs working in Canada			$55,500
Canadian postdocs working abroad			$54,000

Table 3 – Average annual postdoctoral income data from all three CAPS surveys.

Our current compensation system devalues the training, experience, and effort of postdocs by making funding success (and therefore income) largely dependent on research output (i.e., publications), failing to adjust compensation for years of training/experience, and creating excessive wage disparity among postdocs; the latter of which is exacerbated by salary top-ups that are commonly provided by institutions/supervisors to postdocs who have been successful in attaining external awards. To put wage disparity into perspective, consider the fact that two peers working side-by-side in the same lab/office, doing similar work, working similar hours, and with similar levels of training/experience can have a 50% wage disparity under our current system if one of them earns < $45,000/year (52% of all postdocs; Fig. 4) and the other is a Banting award holder ($70,000/year) who receives a $10,000/year salary top-up from his/her institution for a total annual income of $80,000.

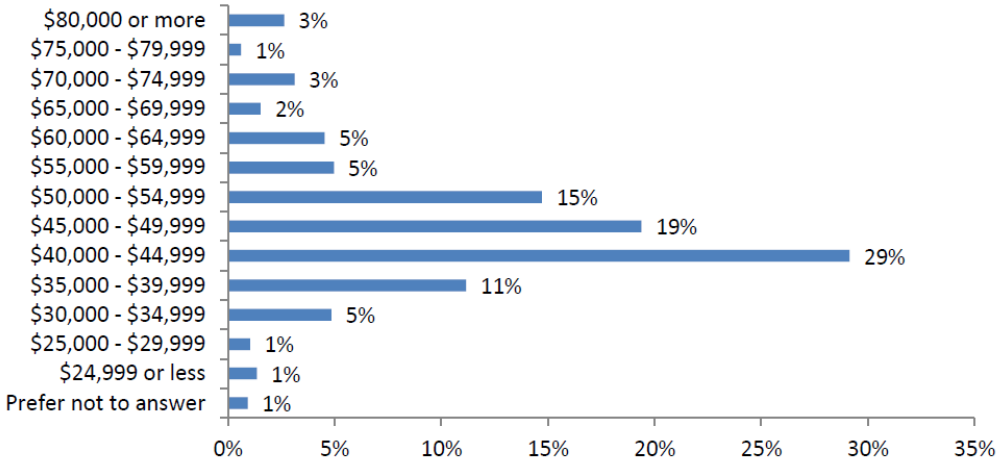

Figure 4 – Gross annual income of all current postdoc respondents on the 2016 survey.

Challenges identified:

- ***Low compensation relative to hours worked***
- ***Low compensation relative to other countries***
- ***Compensation not adjusted for years of experience***
- ***Excessive wage disparity***

1.4 Female postdocs

Nearly equal proportions of men (51%) and women (47%) responded to our 2016 survey, and our data indicated no difference in the average salaries of male and female postdocs. However, we did find that women (45%) were less likely to be satisfied with their career options than men (55%). According to our 2016 data, 39% of female postdocs currently working in Canada do not have access to paid parental leave, and another 33% were not sure if they had access. Although the Tri-council and some other funding agencies in Canada include paid parental leave benefits for their award holders, the approach of only providing maternity leave to women who succeed in securing personal funding does little to help the average female postdoc in need of support after childbirth or looking to start a family in the near future. As a result of these policies, an unknown number (this is not tracked) of promising young female researchers are forced to take unpaid maternity leave after childbirth each year in Canada. This represents a serious disadvantage for female postdocs compared to their male counterparts, and this is reflected in the fact that 26% of female respondents on our 2016 survey chose paid parental leave as one of the top three benefits they desired, as compared to only 19% of postdocs overall.

Challenges identified:

- ***Lack of access to paid maternity leave***

1.5 International postdocs

Between 2009 and 2016, the proportion of respondents on our surveys that indicated that they were permanent residents dropped from 17% to 13% and the proportion of postdocs in Canada on a work permit declined more dramatically, from 39% to 29%. International postdocs face unique challenges in coming to

Canada to pursue training (see Fig. 5). While those challenges vary depending on how long a postdoc has lived in this country, it is worth noting that visa and work permit issues are consistently cited as a challenge by ~50% of international postdocs regardless of when they arrived in Canada. The fact that only 7% of respondents on our 2016 survey indicated that they had access to legal/visa services through their institutions suggests that this issue has been largely ignored by our system to date. Based on the input of our members, there would also appear to be a general lack of support for English language training for international postdocs, as English training courses are not usually offered as part of postdoctoral training and only small discounts (if any) are typically offered to postdocs who wish to take courses to improve their English.

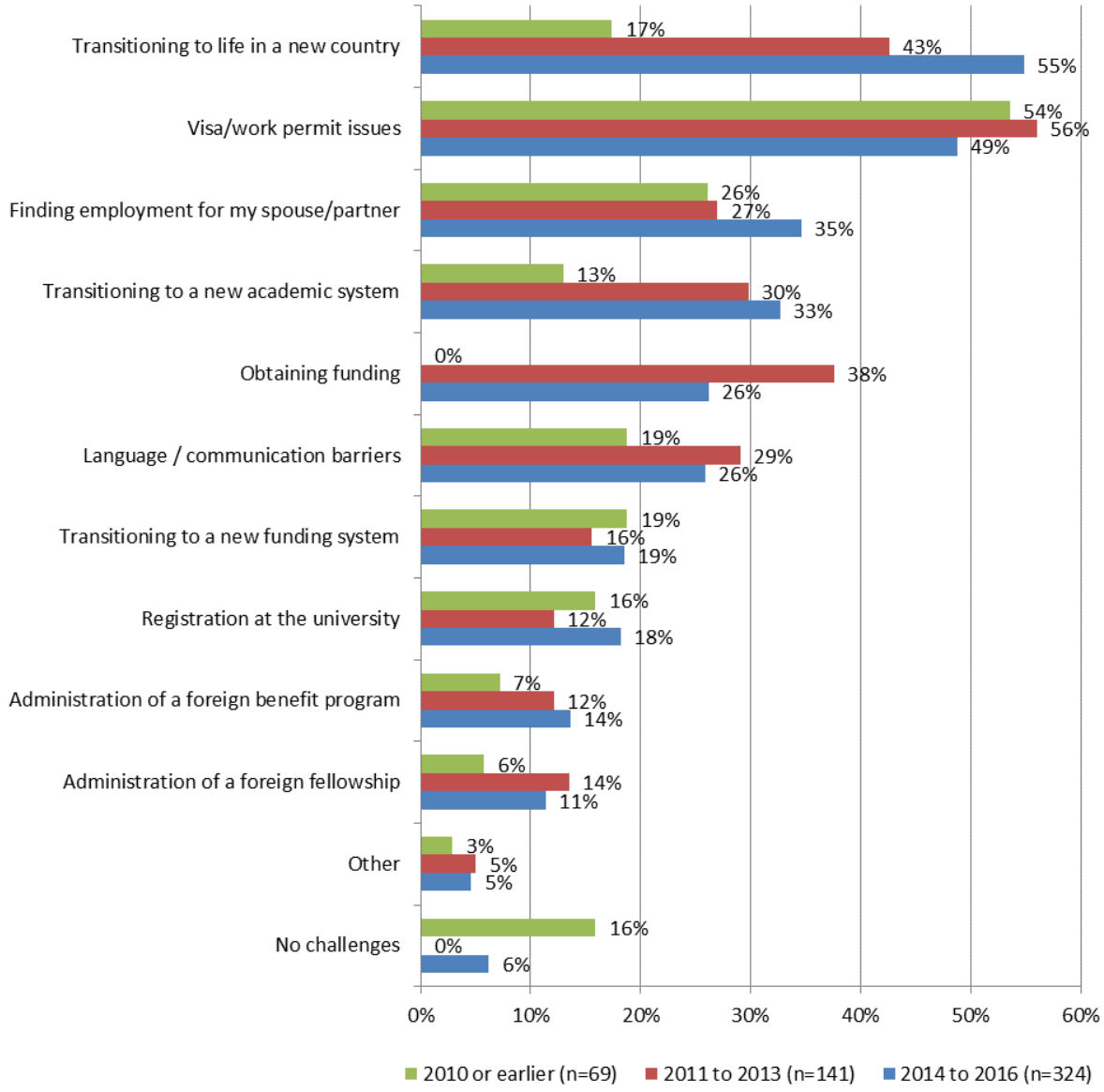

Figure 5 - Challenges encountered by international postdocs responding to the 2016 survey by year moved to Canada.

The majority of international postdoctoral scholars who come to Canada want to stay, as 75% of international postdocs either planned to stay or were unsure whether they would stay/leave in our 2013 sample. Many unsure individuals expressed a desire to stay, but also concern that they would eventually be forced to leave due to immigration issues and the lack of job prospects in particular. The CAPS Executive is contacted fairly regularly regarding immigration-related difficulties faced by international postdocs, and this has increased in frequency somewhat since the implementation of the new Express Entry system. In response to this issue we submitted a letter to the Minister of Immigration, Refugees and Citizenship earlier this year calling for changes to that system. Giving employee status to international postdocs would help a great deal in this regard, as despite the fact that these individuals do some of the most highly technical work in our country, Canada fails to recognize their efforts as 'skilled work experience' for the purposes of immigration.

Challenges identified:

- ***General lack of support specific to the needs of international postdocs***
- ***Lack of access to visa services at institutions***
- ***Lack of access to free or discounted English language training***
- ***Immigration issues related to the lack of recognition of research as 'skilled work experience'***

1.6 Past postdocs who left Canada

The need for better/more job opportunities for postdocs is clear in our 2016 survey data, as a full 1/3 of past postdocs left Canada to work abroad (n=141), and nearly half of them cited poor job prospects as the primary reason why they left (Fig. 6). This speaks strongly to the need to create more jobs requiring postdoc-level expertise in Canada in order to increase the retention of the highly-qualified personnel trained in our system.

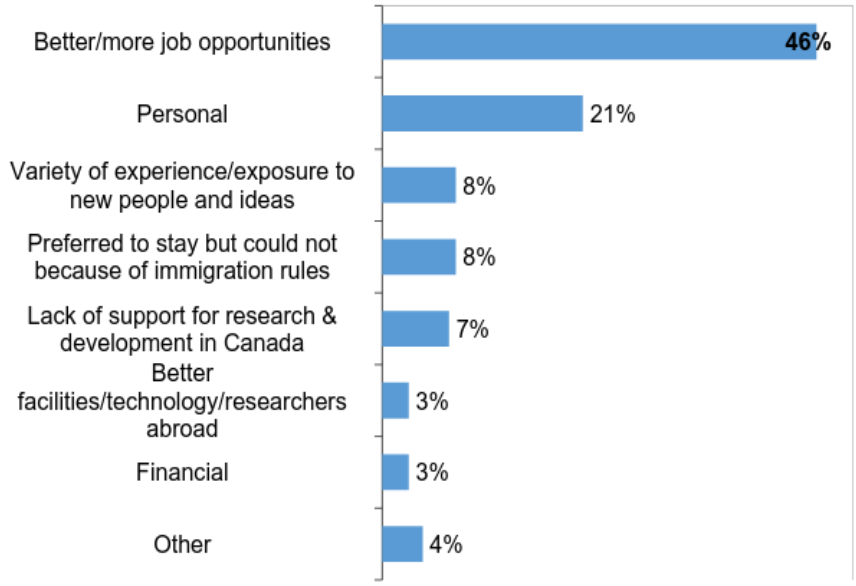

Figure 6 – Reasons why past postdocs decided to leave Canada.

Challenges identified:

- ***Lack of suitable jobs for postdocs in Canada***

1.7 Postdoc mental health

Long work hours, isolation, and uncertain career prospects can be very stressful for people, and coupled together with financial uncertainty, a lack of job security, and a lack of benefits, these factors take a considerable toll on many postdocs in terms of their mental health. To gauge the mental health of postdocs on the 2016 survey, we asked respondents whether they had ever experienced specific thoughts / feelings / conditions related to mental health for more than a month at a time during their postdoctoral training (Fig. 7). About ¾ of postdocs had experienced an issue related to mental health during their appointment, some of which were fairly serious, such as anxiety or panic attacks (30%), depression (27%), and thoughts of self-harm/self-loathing (7%). The former two figures are considerably higher than the national averages for depression (8%) and anxiety disorders (12%) reported by the Mood Disorders Society of Canada (2009), which highlights the need for improved mental health support for postdocs working in this country, many of whom are denied access to on-campus mental health support.

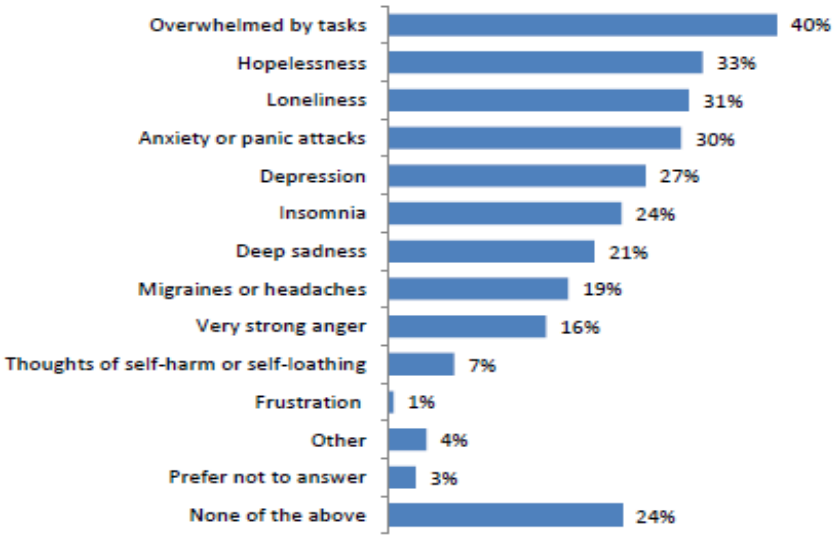

Figure 7 – Postdoctoral mental health (2016 survey). Proportion of respondents who experienced various mental health issues for more than a month during their postdoctoral training.

Challenges identified:

- ***Lack of recognition or monitoring of mental health in the postdoc population***
- ***Lack of support in terms of mental health needs***
- ***Lack of access to on-campus mental health support***

1.8 Postdoctoral Training

1.8.1 Training satisfaction among postdocs

The majority of postdocs were at least 'somewhat satisfied' with their training to date in all three surveys (Table 4). The specific elements of training that most postdocs were at least 'somewhat satisfied' with on the 2013 and 2016 surveys included: level of supervision/independence, resources and facilities, work environment/peer interactions, opportunities for research collaboration, work/life balance, and funds for research and travel (Fig. 8).

General Satisfaction	2009	2013	2016
Completely satisfied	55%	20%	21%
'somewhat satisfied'	('satisfied')	48%	51%
Neither satisfied nor dissatisfied	26%	15%	12%
Somewhat dissatisfied	19%	12%	12%
Completely dissatisfied	('dissatisfied)	5%	4%

Table 4 – Overall satisfaction with postdoctoral training to date. Across all 3 surveys, the majority of respondents reported that they were at least 'somewhat satisfied' with their training to date.

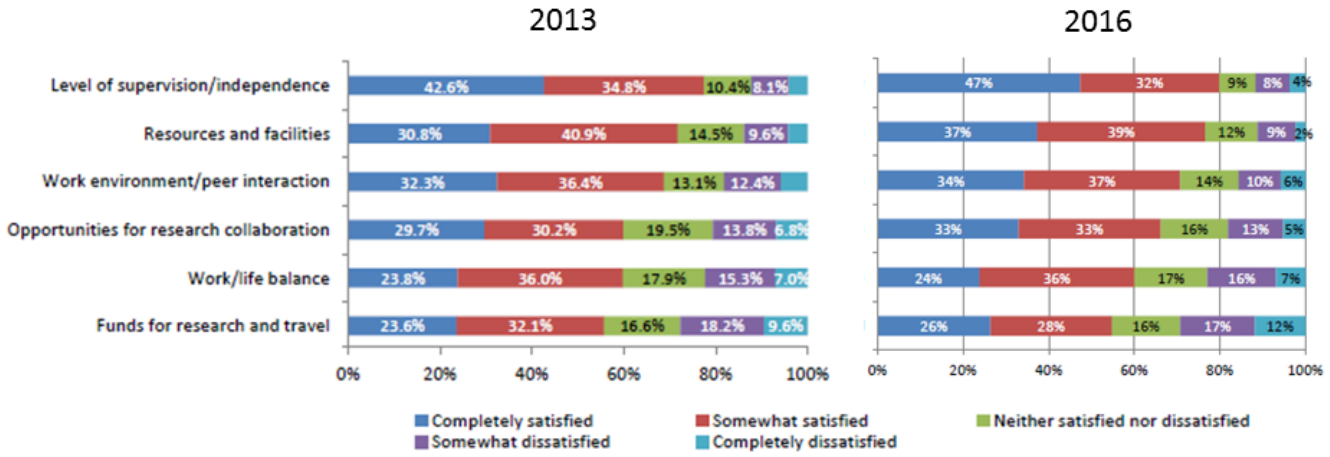

Figure 8 – Satisfaction with elements of postdoctoral experience. In 2013 and 2016 surveys over ½ of postdocs were at least 'somewhat satisfied' with factors directly related to research faculty training.

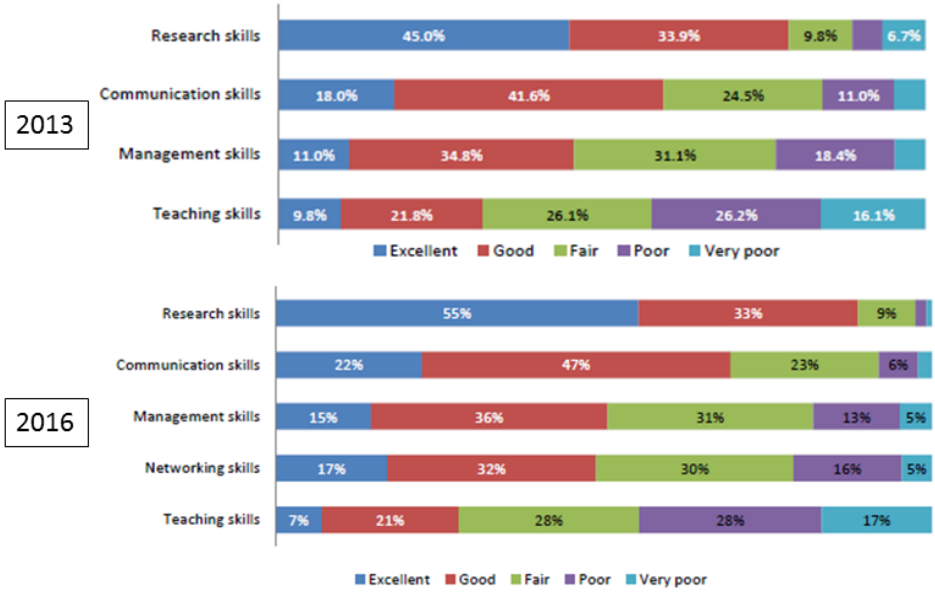

Figure 9 – Quality of postdoctoral training in preparing for career. The majority of respondents on both the 2013 and 2016 surveys rated the quality of training best for research skills, followed by communication skills, management, networking (2016 survey only), and teaching skills.

Most postdocs on those two surveys rated the quality of training they received with respect to research skills as 'excellent'/'good' on the 2013 (79%) and 2016 (88%) surveys. Communication training was also rated well (≥60% 'excellent'/'good' on both surveys), management and networking skills training less so (~50% 'excellent'/'good' on the 2016 survey). In contrast, the quality of training with respect to teaching skills was largely rated as 'fair' to 'very poor' (Fig. 9). These results indicate room for improvement in the training of all of those skills with the exception of research skills.

Challenges identified:

- ***Need for improved training of communication, management, networking, and teaching skills***

1.8.2 The value of postdoctoral training with respect to labour market outcome

The 2012 Annual Postdoc Survey conducted by Science found that only 20% of former postdocs landed a tenure-track research faculty position (Powell, 2012). This begs the question of what the value of postdoctoral training is for the other 80% of postdocs who end up in other careers. To address that question we decided to investigate the labour market outcome of postdocs training in Canada.

It is generally recognized that additional education costs a person potential wages during the training period, but pays off long-term as the higher wages offered by jobs available to those with more advanced training allow people to catch up and eventually surpass the cumulative income of their lesser-educated peers. For example, a study examining income data from 1971-2006 found that PhD holders in the workforce earn an additional $12,680/year on average compared to Master's graduates, and this extra income allowed the average PhD holder to close the cumulative earning gap after just over 22 years in the workforce (Edge & Munro, 2015). In a 2014 report for Statistics Canada, Ferguson and Wang (2014) examined the labour market outcomes of Canadians who graduated in 2009-2010 using data from the National Graduates Survey conducted in 2013. In contrast to the work of Edge and Munro, these authors found that the median annual income for all full-time employees with a PhD was $75,000 – which was only $5,000 more than the median for a Master's graduate. To examine the low wage return they observed the authors separated PhD holders working as postdocs from those that were in non-postdoc positions, and found that postdocs had a median annual income $32,000 lower than that of PhDs who entered the workforce without additional training (Table 5).

	College	Bachelor	Master	PhD	PhD working as a postdoc	PhD working in a non-postdoc position
Median Annual Income (2013 $)	$41,600	$53,000	$70,000	$75,000	$50,000	$82,000

Table 5 – Estimated gross annual income of 2009-2010 graduates working full-time in 2013 by level of education. Adapted from Ferguson & Wang, 2014

Adjusting for inflation, the median annual income for PhD holders not working as postdocs reported above would be $85,700 in 2016. In comparison, the median annual income for postdocs working in Canada on our 2016 survey was $42,500, which would indicate that postdoctoral training in Canada today costs the average

(or median) postdoc approximately $43,200/year in foregone wages. Table 6 depicts the estimated cumulative foregone wages for the average postdoc working in Canada by years of training.

	Duration of Postdoctoral Training				
	1 year	**2 years**	**3 years***	**4 years**	**5 years^**
Cumulative foregone wages	$43,200	$86,400	$129,600	$172,800	$216,000

Table 6 – Estimated cumulative foregone wages over the course of postdoctoral training in Canada today. *= median years of postdoc training for past postdocs in the 2016 survey
^maximum duration of postdoc training in Canada

Since we had data from postdocs who had completed their contracts in the last 4 years, we examined the wage return provided by postdoctoral training. The median annual income reported by past postdocs on our 2016 survey fell right at the boundary between two dollar-range options, indicating a value just under $75,000/year, which was ~$10,000/year less than the previously reported median annual income for PhDs not in a postdoc position (adjusted to 2016 dollars). The majority of these individuals were employed full-time (80%), but an alarming 9% were unemployed, which is more than double the 4% unemployment rate among PhDs in Canada reported previously (Edge & Munro, 2015). **In the absence of evidence for increased employment or median salary relative to PhDs without postdoctoral training, these findings indicate that the completion of postdoctoral training provided no labour market outcome advantage relative to the completion of a PhD alone for the average past postdoc (n=479) who responded to our 2016 survey.**

One potential explanation for this is the fact that postdoctoral training does not provide additional credentials to the trainee. In the absence of a degree, diploma, or certificate of some kind, employers outside of academia are likely to view postdocs and PhDs as largely equivalent and the additional years of research experience for postdocs would generally only be advantageous when seeking research positions in industry or academia.

Our 2016 survey data also revealed that the labour market outcome for international postdocs who completed their training in Canada in the last 4 years (n=141) was poorer than that of the average Canadian former postdoc (n=338), as non-Canadian past postdocs had nearly double the unemployment rate (14%) of their Canadian counterparts (8%) and a lower median annual income of ($55,000-$64,999 versus $75,000-$99,999, respectively). Although female former postdocs (n=215) fared better than male former postdocs (n=254) in terms of unemployment (7% versus 11%, respectively), this was primarily due to increased part-time employment, as slightly fewer women (78%) than men (80%) were working full-time. In addition, male respondents had a higher median annual income ($75,000-$99,999) than female respondents ($65,000-$74,999). These findings emphasize the need to improve the labour market value of postdoctoral training, particularly for female and international postdocs.

These issues should be revisited using larger samples from existing Statistics Canada databases (if available) and examined more thoroughly in future research, as labour market outcome would provide a useful metric to determine whether changes implemented to our system as a result of this review have been effective long-term. Targeted study of these issues is essential to determine the value of postdoctoral training to the trainee.

Challenges identified:

- ***Lack of labour market outcome advantage for postdocs relative to PhD holders***
- ***Poorer labour market outcome for international past postdocs***
- ***Poorer labour market outcome for female past postdocs***
- ***Lack of balance between job market and number of postdoctoral trainees***
- ***Need for more/better jobs available to postdocs in working in Canada***
- ***Facilitating transitions of postdocs (who are not competitive for faculty positions) out of academia***

1.8.3 Career development

Both the 2009 (Standford et al., 2009) and 2013 (Mitchell et al., 2013) survey reports highlighted the need for an increased focus on career development (particularly with respect to non-academic careers) and more professional development opportunities for postdocs in Canada. To their credit, a number of institutions and agencies responded to this need by implementing new programming for postdocs and/or expanding existing programs for graduate students to include postdocs.

Some examples of career/professional development opportunities available to postdocs in Canada today:

- Campus Alberta Neuroscience trainee programs/retreats (http://www.albertaneuro.ca/content/sharededucation)
- Hotchkiss Brain Institute: Research, Education and Leadership in Neuroscience (REALISE) program (http://www.hbi.ucalgary.ca/our-education/realise)
- McGill University: Skillsets and Career Planning Services (https://www.mcgill.ca/gps/postdocs/fellows/benefits-resources)
- University of British Columbia Professional Development Seminars (https://www.postdocs.ubc.ca/professional-development-events)
- Mitacs (http://www.mitacs.ca/en/programs/step#postdoc)

While we view this as a very positive sign, the professional development workshops currently available to postdocs are often stand-alone, one-time events that last only a couple of hours and lack cohesion, so they may not provide the kind of time and feedback required to truly build specific skill sets and optimize learning. In addition, the programs that do exist tend to focus on skills that are applicable to academic training and research, or general development, as opposed to non-academic career development per se, and postdocs are often expected to 'make up' time away from their research, which can be exceedingly difficult for a group of people who already tend to work >40 hours/week.

In 2013 81% of postdocs began their position with 'university research faculty' as a career goal and for 64% of respondents that was the only goal reported. However, by the time they completed our survey the proportion of respondents aspiring to a faculty career had dropped to 69%. Fastforward to 2016, and we start to see that tenure-track faculty positions had lost some favour at the outset, as only 75% of respondents reported that as one of their initial career goals, and by the time of the survey that value had dropped to 62%. This data indicates that fewer postdocs today are starting their training with the aim of becoming a faculty member and that over time during training an increasing number of postdocs abandon that goal and look to alternative

careers. In contrast, the proportion of postdocs selecting all other career goals increased during training in both of those surveys (particularly in 2016). The most commonly cited reason for changes in career goals was "unfavourable job market". The need for increased support during transitions to both academic and non-academic careers was a common theme raised by postdocs providing input for this report.

It is clear that postdocs are becoming more aware and concerned about the lack of research faculty positions available in Canada over time, and they are looking to alternate careers more and more as the reality of this situation sets in during their training. As a result, postdocs today are likely to seek professional development and mentorship opportunities related to non-academic careers. Despite that, a large number of respondents to the 2013 and 2016 surveys reported zero exposure to non-academic career opportunities (51% and 43%, respectively). Although those numbers suggest that more postdocs were exposed to non-academic career opportunities in 2016, which is promising, the proportion of postdocs who expressed a desire to learn more about potential careers outside of academia remained unchanged from 2013 to 2016 (84%). Availability of career development programs/workshops is not the only factor to be considered here, as only 45% of postdocs reported that their supervisors' at least 'somewhat encouraged' professional development training (Fig. 10). This speaks to the need for professional career counselling for postdocs, as research faculty supervisors are not always be the best people to give objective career advice to trainees, particularly in the case of postdocs who develop career goals unrelated to research.

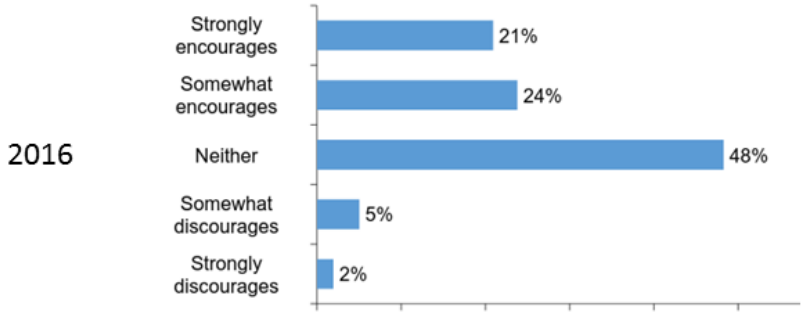

Figure 10 - Level of encouragement from postdoctoral advisor to pursue professional development training.

With that in mind, it is interesting to note that 51% of postdocs did not know whether they had access to a career counsellor at their institution, and of those who did know about half as many had access (16%) as did not (33%). The 2013 survey data revealed nearly identical values, suggesting little or no change in the availability of career services support in the past 3 years. Clearly this is an area that needs improvement, not just in terms of services offered, but also in terms of communication about those services and encouragement to pursue non-academic careers.

Challenges identified:

- ***Need for more research faculty positions***
- ***Need for better/more non-academic career development***
- ***Need for improved support for academic and non-academic career transitions***
- ***Lack of supervisor encouragement for non-academic career goals***
- ***Lack of access to professional career counsellors***

2 Summary of challenges

Under the current research/training system in Canada postdocs face a considerable number of challenges that negatively impact their financial stability and security, physical and mental wellbeing, family aspirations, and future career prospects. Here, we summarize the challenges to postdoctoral wellbeing and success identified in the preceding sections of this report and provide a summary of the broader challenges to our system of research/training that underlie those issues (depicted in Table 7). Taken together, these factors limit Canada's ability to attract, develop, and retain postdoctoral talent, which has negative implications on our future capacity for research and innovation as well as our production of world-class researchers and academic faculty.

Challenges to postdoctoral success & wellbeing	Challenges to our system of research/training
Employment status ambiguity	Need for improved compensation, protection, and benefits for postdocs
Access to social support (EI and CPP)	Balancing research production and trainee needs
Access to other benefits (health, dental, vison, extended health, etc.)	Decline in recruitment or retention of young and/or international postdocs
Low compensation	Increasing length of postdoctoral training times
Support for mental health	Providing personal support services for postdocs
Support for female and international postdocs	Improving academic and non-academic career development and facilitating career transitions
Aging of postdoc population	Need for tracking of postdoctoral outcomes
Support for academic career transitions	Low availability of jobs requiring advanced research training and expertise in Canada
Support for non-academic career development and career transitions	Increasing the labour market value of postdoctoral training relative to PhD training

Table 7 – Major challenges to postdoc success and wellbeing and related challenges to the current research/training ecosystem in Canada.

3 Recommendations

Towards the goal of addressing the challenges facing postdocs and broader research/training system today, we present the following list of recommendations including detailed justifications and suggestions regarding implementation for most.

1) Create and implement uniform postdoctoral policies

Under the current research/training system in Canada, research production is heavily incentivised and institutions have largely been left to establish their own postdoctoral policies. Within this context it comes as little surprise that most institutions have establish policies that focus primarily on minimizing research labour costs and maximizing research output. Those institutional policies are highly variable across Canada and even within the same provinces, generally fail to provide appropriate levels of compensation and benefits given the work, training, and expertise of postdocs, and are largely out of touch with the needs of the labour market (e.g., increasing the availability of postdoctoral positions despite the lack of availability of research faculty positions). **There is a clear conflict of interest between what is best for institutions and research faculty (maximizing research output while minimizing cost) and what is best for the postdoctoral trainee population (reasonable compensation, protection and benefits, as well as direct support for career development). In light of that conflict, research institutions cannot and should not be expected to set policies that are advantageous to postdocs, because those policies would likely be against their own best interests.** Thus we believe that top-down intervention will be required to properly address the challenges facing postdocs training in Canada today, and we recommend the adoption of uniform postdoctoral policies at the federal and/or provincial levels to achieve that goal.

2) Adopt minimum employment standards for postdocs

We believe that the implementation of minimum employment standards for postdocs will make the Canadian research/training system more competitive with the systems established in other countries and thus position Canada as a world leader in postdoctoral training in the future. Ideally these standards would be adopted as part of a National Postdoctoral Policy with implications for and ties to Provincial Postdoctoral Policies that apply to every postdoc working in this country, regardless of citizenship, immigration status, or source of funding. The latter is a key point, as the current move towards unionization of postdocs in this country divides postdocs along arbitrary lines, providing bargaining rights and protection only to those who secure "employee status" (typically those funded internally) and leaving a large number of postdocs (those funded by external awards) at the mercy of highly variable and unfavourable institutional policies. We suggest that the adoption of these policies be made mandatory in order to maintain institutional eligibility for Tri-Council grants and fellowships, and that employment standards for postdocs be monitored closely in the future to ensure compliance.

Recommended minimum employment standards for all postdocs working in Canada:

A) Minimum annual salary

The minimum annual salary for a full-time postdoc conducting research at a Canadian institution should be at least $47,500 (CAD) to start and should increase with years of experience.

Justification:

If we want to remain competitive with other countries, and particularly the United States (US) in terms of attracting the best and brightest international postdocs and retaining Canadian talent, we need to improve the average salary of postdocs working in Canada. With the passing of the Fair Labour Standards Act in the US, the overtime payment threshold will be increased to $47,476 (US), effective December 1, 2016. To remain

competitive Canada should at least match the absolute dollar value of the US minimum. Matching the exact value of the new US minimum in Canadian dollars (~$62,500 CAD) is also an option, and should be considered as a future goal if adequate research funding is in place to support such a policy. For now this may not be required to be competitive with the US, as improving the protections and benefits available to all postdocs working in Canada (see below) would help attract talent regardless of the pay disparity because that type of support is not generally provided in the US; although it is in the UK and some parts of Europe. Scaling wages according to years of experience would also make Canada more competitive, as this practice is currently in place in other countries (e.g., US and UK) and it would demonstrate that our system values the expertise and experience of the postdocs we are training.

Implementation notes:
This minimum should be adopted as the new standard for postdoctoral salary support in grant applications for all federal funding agencies, and the institution where work is conducted and/or the postdoc's faculty supervisor(s) should be required to cover the difference between this amount and any fellowships / awards received by their postdoctoral trainees.

Impact on system:
Increasing the labour costs associated with the average postdoc would dis-incentivise the overproduction of postdoctoral trainees.

B) Access to social support programs

All postdocs working in Canada, regardless of citizenship, immigration status, or source of funding should have access to the protections provided by EI and CPP.

Justification:
Postdocs are a fairly unique group. They perform a vital role in research and innovation in our country, pay full tax on their income (including fellowships) to the federal government and most provinces, but are denied access to the basic protections provided to the average Canadian worker by EI and CPP. In addition, the trainee or student status applied to most postdocs prevents them from accessing social support options available to the self-employed. We believe that the lack of access to social support programs places postdocs working in Canada at a disadvantage relative to the average Canadian worker.

Implementation notes:
There are three ways that this standard could be implemented: 1) all postdocs could be deemed employees of the institutions where they conduct research under the current definition; 2) a new class of 'employee' specific to postdocs could be created that explicitly guarantees postdocs access to EI and CPP; or 3) all postdocs could be deemed employees for the purposes of access to EI and CPP.

Option 1 is complicated by the fact that the current definition of an employee in Canada necessitates direct payment by an employer, which would automatically exclude externally funded postdocs. Option 2 would be a very complicated and lengthy process, but the need for direct payment could be explicitly omitted from the definition of postdoctoral 'employees' while access to all of the benefits available to other employees could be

included. In comparison, option 3 provides a relatively simple approach that would allow full access to EI and CPP for all postdocs working in Canada, and this is the option we recommend for implementation.

Ideally, the option to waive this coverage would only be available in cases where a postdoc holds a foreign award that already includes similar/equivalent coverage provided by another country.

Implementation notes – Option 3:
Option 3 could be implemented by petitioning the Canada Revenue Agency (CRA) to pass a special ruling that states: "For the purposes of access to Employment Insurance and the Canada Pension Plan, all postdocs working in Canada (regardless of citizenship, immigration status, or source of income) are now considered employees of the institutions at which they conduct their work."

A ruling of this nature is entirely within the power of the CRA, and there is even precedence for this kind of ruling in the taxi industry (CRA Guide T4001), whereby drivers who are not paid directly by the companies they drive for are treated as employees for the purposes of EI. This ruling also stipulates that the companies must pay both the employee and employer portions of EI premiums.

The cost of this coverage could be handled in any number of ways, as EI and CPP employer premiums could be charged to the postdoc's institution or supervisor and the employee premiums could be covered by the postdoc, or the CRA could make a more complicated ruling similar to the one for the taxi industry described above. **We believe that the optimal arrangement would be to simply redirect a portion of the provincial/federal income tax paid by each postdoc to cover the entire cost of their participation in EI and CPP**. The average postdoc pays more than enough income tax each year to cover both the employer and employee premiums for EI and CPP. For example, the total amount of tax paid by the average postdoc ($46,600 gross salary) living in Alberta in 2016 would be $8,200 which would cover the total cost of that individual's EI and CPP premiums ($6,400) with $1,800 to spare.

While this may seem like an unorthodox suggestion, even compared to the situation in the taxi industry, it has some obvious advantages. For example, it would partially rectify the government's inconsistent policy of taxing postdocs, but not students, on scholarship income. It would also help to offset the relatively low average annual salaries of postdocs working in Canada, by providing essential support at no additional direct cost to the individual postdoc, and it would help minimize the additional labour costs associated with postdocs if/when a minimum annual salary for postdocs is implemented.

Impact on system:
This policy would effectively side-step the employment status issue by granting postdocs' access to EI and CPP without officially changing their employment status, so it limits access to unionization procedures while providing much needed protections. It would also eliminate the disparity in social support access in our current system and eliminate the need for the Tri-council and other funding agencies to administer their own parental leave coverage, which would decrease the use of research funds to cover expenses not directly related to research.

Caveats:
Quebec administers its own provincial pension plan, the Quebec Pension Plan (QPP), so access to that plan would have to be negotiated at the provincial level.

In using individual tax contributions to cover the cost of this policy, we may wind up excluding a proportion of postdocs who desire access to EI and CPP. Income tax is paid to the CRA by the vast majority of postdocs working in Canada, but there are exceptions, including a subset of Canadian postdocs working in Quebec who are tax exempt, Canadian First Nations postdocs, and postdocs whose salaries are paid directly by foreign agencies. The latter group is likely to already be paying into similar social support systems in their country of origin, but they may still desire access to EI and CPP if they plan to stay in Canada long-term. Careful consideration of these groups would be required in the drafting of this policy, in order to avoid excluding postdocs who desire access to EI and CPP from this program simply due to their tax status.

General benefits:
By providing access to EI we would eliminate female postdocs being forced to take unpaid maternity leave – which happens more often than most would suspect in this day and age. Providing access to paternity leave benefits through EI would not only provide a reasonable amount of paid leave for new fathers, but would also allow parents to share parental leave more effectively – which is difficult/impossible when one parent has EI coverage and the other is not covered or has privately-managed parental leave from an institution or funding agency. The lack of this kind of coverage is a major barrier to the equality of female postdocs in the Canadian research/training system and a cause of distress among postdocs who wish to start families. In addition, this would help to alleviate the savings deficit faced by postdoctoral trainees due to the lack of access to CPP (see above) and it would provide other vital protections such as sick leave and job-loss coverage; the latter of which may be needed by postdocs more than one might assume considering the 9% unemployment rate reported by past postdocs in our 2016 survey. This policy would also go a long way in helping to correct an unhealthy cultural bias in academic research, by making it clear that the Canadian research system does not expect postdoctoral trainees to have to choose between their work and their personal aspirations regarding family and children.

C) Access to other benefits

All postdocs working in Canada, regardless of citizenship, immigration status, or source of funding should have access to standard employee benefits.

Justification:
A large number of postdocs working in Canada lack access to standard employee benefits (see Fig. 2 for details). Given that these benefits are typically negotiated by unions, it is likely that non-unionized postdocs (including those on external funding at institutions with postdoctoral unions) represent the group most affected by this. Because the institution does not directly pay postdocs who secure external salary support, they are rarely classed as employees and often denied access to benefits. While one might expect institutions to be more than willing to pay benefits for someone who is practically working for them for free, they are

under no obligation to do so, and many do not. These policies are detrimental to postdocs, and particularly to the almost 1/3 of postdocs with dependent children, and the 50% of those families with more than one child. The cost of unexpected health expenses is something that the average postdoc working in Canada (earning $46,600/year) may struggle to afford, and in the absence of long-term disability and life insurance, the families of postdocs are left particularly vulnerable.

Implementation notes:
We recommend that all postdocs working in Canada (regardless of citizenship, immigration status, or source of funding) be provided access to standard employee benefits, including:

- Health insurance
- Dental insurance
- Extended health insurance
- A prescription drug plan
- Vision/eye care coverage
- Long-term disability coverage
- Life insurance
- Family coverage
- Vacation time

With respect to covering the cost of this policy, we offer the following potential solutions:

- Institutions/supervisors could be instructed to cover the costs of benefit plans directly using research funds. This would seem fitting, given that benefits are a normal part of labour costs in other sectors, and it may have the added benefit of dis-incentivising institutions/supervisors from hiring too many postdocs, which would be beneficial in terms of reversing the current trend towards continually increasing the number of postdoctoral trainees despite the lack of available jobs for people with that level of research training.
- The benefits plan itself could also be tailored to minimize the cost to research funding by having postdocs cover a portion of this expense directly. The optimal set up for this might involve institutions or supervisors paying for a base plan with minimal coverage, and then offering postdocs a variety of optional upgrades to that plan at cost.
- **As an alternative to accessing benefits plans through individual institutions, a national group insurance policy could be established through CAPS or another organization / government agency.** This program could automatically provide a policy to new postdocs with all or part of the premiums paid by the institution at which they work. Given the potential expense of benefits packages, a national insurance policy open to all postdocs in Canada may help to minimize the cost of participation on an individual basis. The CAPS Executive is already working with insurance providers toward that goal, but in the absence of employer contributions we have thus far been restricted to single-payer options that many postdocs would be unable to afford. Matching contributions by institutions or government assistance in the form of a tax-rebate for postdocs to support benefits coverage would go a long way to ensuring that all postdocs had access to benefits.

Impact on system:
This coverage will provide much needed support, particularly for postdocs with families, and by including externally funded postdocs it would help to minimize the disparity in access to benefits in our current system and ensure that postdocs are not penalized in terms of the benefits they can access for succeeding in securing their own funding.

3) Track postdoctoral employment conditions and outcomes

There is a general lack of data with respect to postdocs in this country, and while institutions have the capacity to collect and share information about postdoctoral trainees, at present they are under no obligation that we know of to report that data to the government or the public. This situation makes it exceedingly difficult to monitor postdoctoral policy and working conditions or track postdoctoral outcomes in Canada, both of which are required to enable the system to adapt to the changing needs of postdocs over time. We plan to address this issue by setting up our own National Postdoc Registry which would allow postdocs in Canada to sign up and provide information about themselves for the purposes of more accurately tracking the number of postdocs, their employment status, annual income, and other key demographic data.

It occurs to us that this might be accomplished on a grander scale with the assistance of the federal government and the Tri-council agencies by creating that registry as a system that tracks postdocs throughout the entire course of their career trajectory. The entry of postdoc information into this system could be mandatory for all publicly-funded institutions and it should include key demographic information (age, gender, marital status, dependents, etc.) as well as data about employment status, and salary and benefits details. When a postdoc finishes their training they could be asked to continue participating in the registry, and if they agree, the system could automatically start sending them yearly emails requesting updates regarding their employment and other factors. The data from this system could be stored in a manner that ensures confidentiality while allowing public access to summarized data for the purposes of analysis. By tracking postdocs during training, this system would allow for oversight with respect to institutional policies around postdocs and their training in this country. By collecting data from former postdocs it would also allow for the tracking of a large number of postdocs long-term, which would provide accurate longitudinal labour market outcome data. That data could be used to examine the need for changes in postdoctoral training policies in the future using key metrics related to labour market outcome such as employment status and annual income.

In the absence of an official registry, we would recommend the implementation of new policies around institutional reporting of postdoctoral data to allow for oversight by the Tri-council or other government agencies at the federal and/or provincial level. The reporting of this data should be mandatory and it should include the number of postdocs, key demographics, and information about employment classification, funding sources, annual income, and access to benefits. This approach would at least provide a mechanism for institutional oversight.

4) Create an independent professional body for postdocs

If a National Postdoc Registry is established, it will need to be managed by a dedicated agency. For those purposes we propose the creation of an independent professional body for postdoctoral trainees (similar to the College of Physicians and Surgeons). This agency could be empowered to monitor postdoctoral

employment standards and notify federal funding agencies in the case of violations. In the future, this agency could also monitor the number of trainees, the research production capacity of the science ecosystem, and the needs of the labour market (academic and non-academic), and provide recommendations to the Tri-council and appropriate Ministries as needed to maintain a closer balance between labour market demand (i.e., available jobs requiring PhD/postdoc levels of research expertise) and the number of postdocs in training. In the absence of such oversight, there is no established mechanism to enable our research/training system to recognize when it is overproducing postdoctoral trainees and adapt to ensure that value of that training to the trainees is maintained with respect to labour market outcomes. This agency could also be responsible for establishing guidelines for institutional postdoctoral policies in the future. And it could even administer benefits to postdocs if a national group insurance policy was established for this group; as suggested in recommendation 2C above.

If this recommendation is not followed, then we would suggest that an existing agency or Ministry be empowered to perform those duties and that the national postdoctoral policy itself include guidelines regarding postdoctoral access to support and services at the institutional level. In our opinion, those guidelines should include the following:

- The adoption of 'postdoctoral fees' (similar to student fees) to cover the cost of access to on-campus support services (legal services, visa services, career services) for postdocs. The lack of such fees is often cited by administrators as a primary reason why postdocs are not given access to the same services and support provided to students and graduate students. Ideally these fees would be mandatory and would be used to provide access to support services on campus and to fund career development programs specifically for postdocs. These fees could also include membership dues for the local postdoctoral association, many of which already help to run professional development workshops and other career-related events for postdocs.
- Recommended strategies to alleviate disparity in training and career outcomes for female and international postdocs, as well as additional support for underrepresented groups in the postdoctoral training environment (e.g., aboriginal trainees).
- Recommended strategies for supporting postdocs with children, such as the provision of childcare subsidies and/or reserved or discounted spots in institutional childcare programs.
- Recommended strategies for addressing the needs of postdocs with respect to mental health.
- Recommended strategies for improving career development and supporting career transitions for postdocs.

5) Support for international postdocs

International postdocs face additional challenges not experienced by Canadian postdocs (Fig. 5), and at present our system fails to address many of these issues, which may explain the decline in the proportion of international postdocs on work permits training in Canada in our 2016 survey data. To address this issue, we recommend improving support for international postdocs in particular, and we provide the following list of potential solutions:

- Recommend that the Ministry of Immigration, Refugees and Citizenship revise immigration policies to include postdoctoral research as 'skilled work experience'.
- Improve access to on-campus visa, work permit, and immigration services for international postdocs, access to which may be covered by postdoctoral fees if our fourth recommendation is implemented.
- Access to free/discounted English language training programs as part of postdoctoral training (perhaps supported by postdoc fees).
- Increased disclosure regarding working conditions and immigration policies to ensure that international recruits have more accurate expectations of the Canadian system

6) Improving postdoctoral mental health

The mental health data from our 2016 survey points to a clear need for improving postdoctoral mental health and access to mental health services and support for postdocs working in Canada. Towards that goal, we provide the following list of suggestions:

- Increase monitoring and awareness of mental health issues among postdocs by supporting mental health surveys
- Improve access to on-campus mental health support at publicly-funded institutions (perhaps supported by postdoc fees)
- Access to a career counsellor or some type of ombudsman at the institutional level to provide personal support for postdocs whose supervisors are abusive. At present there is no mechanism in place to support postdocs in this situation at most institutions - short of quitting and moving to a new position. The latter may not be a viable option for international postdocs on work permits, so this group is particularly vulnerable to personal abuse by authority figures.
- The adoption of the recommended minimum employment standards policy (see above) would help to alleviate some of the stress related to finances and working conditions for postdocs in Canada
- As part of the minimum standards policy, the adoption of reasonable paid vacation leave for all postdocs working in Canada would go a long way in reducing stress related to excessive working hours.

7) Revise funding regulations

In the current Canadian research/training ecosystem funding decisions are largely based on research productivity as measured by the number (and impact factor) of publications. The focus on publications as the primary metric of productivity and therefore research success in academia has been widely criticized of late as the root cause of a number of problems in science, including the increase in the number of 'unread' publications and incidents involving the falsification of data. In addition, we would add that this approach has dramatic and detrimental effects on trainees in our system, as it leads directly to the prioritization of research production over trainee wellbeing and career development. In the context of limited funding resources, the pressure to produce data for publication drives our reliance on trainees as inexpensive and disposable labour, which directly impedes progress with respect to improvements in postdoctoral policy. Here we provide recommendations to address this issue, as well as additional suggestions provided by postdocs working in Canada. The topic of potential funding for career development initiatives is dealt with in a later section.

Grant-level funding decision recommendations:

- Rebalance faculty incentives by decreasing reliance on publications and increasing the weight given to other signs of productivity (e.g., attendance of meetings, public engagement, online reports, etc.), teaching, academic service, and the training of highly-qualified personnel such as postdocs.
- What weight is given to publications should be based on the number of citations of the actual work (drawn from a specific list of reputable sources) rather than relying on a journal's impact factor to determine the potential influence of a publication on the field.
- Incentivise training and career development contributions by including an evaluation of the career outcomes of all previous PhD and postdoctoral trainees. For these purposes, the outcomes of trainees who transitioned successfully to desirable non-academic careers should be given equal weight to those who remained in academic research.
- Allow postdocs and research assistants/associates (RAs) to be co-principal investigators (co-PIs) on research grants that will (in whole or in part) pay their salary. While the restriction against salary support for faculty is understandable, these positions do not equate to that of a full faculty member, so blocking postdocs and RAs from applying as co-PIs only creates a situation where they are expected to help write a grant without being able to take credit for their work because they cannot claim authorship or ownership of the grant on funding applications. This effectively devalues the efforts of the trainee, and since this is not the case in other countries (e.g., NIH grants in the US), it also disadvantages postdocs trained in Canada when they compete for faculty positions against people from countries that allow this practice.
- Any existing barriers to the use of grant money for paying premiums for EI/CPP or benefits for trainees or staff should be removed – these expenses should be considered part of the cost of doing research.

Fellowship-level funding decision recommendations:

- Increase the availability of bridging funds to facilitate the transition from postdoc to faculty member for early career researchers.
- Increase funding allocations to support the higher costs of postdocs if our recommendation regarding compensation is implemented. In this case, we would also suggest that the Tri-council revisit the topic of the maximum duration of postdoctoral appointments/support, as the current limit of 5 years may not be ideal in all fields due to disparity with respect to the amount of time and number of publications required to be competitive for faculty positions.

8) Enhance support for non-academic career development and transitions

The focus on research production and the pressure to publish have resulted in a system that puts training and career development second to data collection and the publication of high-impact publications. This has led to a situation where the majority of the day-to-day activities of trainees are eaten up by data collection that could perhaps be better accomplished by professional researchers (such as research assistants or staff scientists). It has also resulted in a lack of training and exposure of postdocs to potential careers outside of academia. This is a problem, as it means that those who don't find a faculty career in academia struggle a great deal to transition to a desirable alternate career in the academic or non-academic sectors. Truly desirable jobs require training, networking and/or professional development, and the almost exclusive focus on research production for postdocs leaves them little or no time to properly prepare for those alternate careers.

Recommendations:

- Provide access to on-campus career services, and particularly professional career counsellors who specialize in career guidance for PhDs/postdocs
- The creation of non-academic career streams that start at the graduate level and are open to postdocs as needed. Input from industry and other stakeholders should be a key part of establishing appropriate training programs for non-academic careers.
- More flexible fellowships that emphasize individual career development over research production and specifically provide support for non-academic career transitions, such as:
    - Funding to support non-academic career development or transitions could provide smaller awards (e.g., $10,000/year) that may be used to offset the salary of a postdoc who wants to pursue more intense mentorship / career development outside of the research environment. For example, a postdoc paid off of a research grant could arrange to conduct research only 4 days a week and pursue their alternate career goal 1 day a week for a period of 6-12 months. In exchange a lower salary would be negotiated with the supervisor (assuming the postdoc is paid off of a grant).
    - Increased funding for internships and joint projects with industry, non-profits, and government agencies through Mitacs
- Expansion of existing career development programs for postdocs and adoption of new programs modeled after successful training programs from other countries, such as the NIH 'BEST' (Broadening Experiences in Science Training) initiative – a 9 month program with training in management, interviewing, and networking with a focus on exploring career objectives.

9) Enhance career opportunities for postdocs in Canada

Lengthy postdoctoral training times are driven by the hyper-competitive job market, not any real training requirement, so the best way to reduce training time is to increase the academic and non-academic jobs available to postdocs and facilitate more rapid transitions out of the postdoctoral training environment. Towards that goal we suggest three broad approaches:

- Job creation
    - Provide additional funds to create more research faculty and staff scientist positions. While the latter would provide additional jobs for PhDs/postdocs, it is essential that these be decent jobs, as the take home pay of someone with a PhD who is no longer in training should not be less than that of a postdoc, and this is the reality for some staff scientists working in Canada today.
    - Increased investment / incentives in research and development in industry to create jobs that require highly skilled trainees.
- Facilitating access to existing non-academic jobs
    - Streaming of PhDs/postdocs into a handful of different career development programs set up for building skill sets required in specific types of careers (e.g., scientific communication, policy/management, etc.).
    - Networking training and events geared to increase exposure of trainees to non-academic jobs/employers (perhaps supported by postdoc fees).
    - Increased exposure to entrepreneurial opportunities and support.

- Promoting the value of postdoctoral training to potential employers
    - The Conference Board of Canada's Centre for Skills and Post-Secondary Education may provide support for this, as they are developing materials to promote the value of PhDs to the public and potential employers (see Bloom & Edge, 2016), all of which would apply equally to postdocs.

4 Concluding statement

The challenges to postdoctoral wellbeing and success identified from our survey data translate into a variety of broader issues facing our current research/training system (summarized in Table 7 above). The recommendations contained in this report address all of those challenges to varying degrees. Adopted en masse, these recommendations would transform the Canadian system, boosting our capacity to attract, develop, and retain highly qualified personnel, and positioning our country as a world leader in postdoctoral support and training.

There are those among us who would advocate for even more drastic changes to the current system, such as the implementation of a true 'apprenticeship' model in which postdocs are largely removed from the research production side of academia and instead provided more training and opportunities geared towards mastering the actual duties (e.g., crafting publications and grants, peer review, management of finances and personnel, teaching and academic service) required in a research faculty position. While this approach is something that many postdocs would agree with long-term, there are concerns regarding the potential impact it would have on Canada's research capacity in the near future, due to the increased labour cost associated with replacing postdocs with staff scientists and research technicians. While much of the evidence presented in this report highlights the need to re-balance our research and training priorities, the need to maintain our productivity in terms of research and innovation as a country is equally important. We believe that the implementation of the major recommendations in this report would provide a means to begin re-balancing those priorities. Over time and with continued monitoring, the training of postdocs can be moved more towards the apprenticeship system at a healthy pace, dictated by conditions and trends in the research/training ecosystem as well as the labour market, towards the goal of balancing the needs of our knowledge-based economy (i.e., our national research agenda) with reasonable and responsible support for the trainees who will play an essential role in driving research and innovation in this country in the future.

We hope that this review is only the beginning of that process, as we truly believe that continued monitoring, assessment, and public dialogue are all essential to the maintenance of a healthy Canadian research/training ecosystem.

In closing, we would like to acknowledge that many of the issues raised in this report may fall beyond the intended scope of the Fundamental Science Review. If the Panel is unable to consider the majority of these issues as part of this review, we would ask that you consider including a recommendation for a more thorough review of the Canadian postdoctoral training system in your final report to the Minister of Science.

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