



**EVALUATION OF THE
COLLABORATIVE HEALTH
RESEARCH PROJECTS PROGRAM**

FINAL EVALUATION REPORT

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EXECUTIVE SUMMARY

The Collaborative Health Research (CHRP) program is a means by which the Natural Sciences and Engineering Research Council (NSERC) and the Canadian Institutes of Health Research (CIHR) support natural sciences or engineering researchers to work collaboratively with health researchers to address interdisciplinary research challenges through distinct research projects. The evaluation covered the time period from fiscal years 1999–2000 to 2008–09. Consequently, the evaluation did not look at the impact of changes to the program that were implemented as part of the 2012 competition, when participation of non-academic knowledge/technology users became a funding requirement. The administration of the program was also transferred to CIHR in 2012. The partner requirements were changed in response to the launch of NSERC's Strategy for Partnerships and Innovation (SPI) in 2009. The strategy intended to build sustainable relationships between university researchers and partners; streamline partners' access to NSERC's programs; connect people and skills by encouraging industry-relevant skills development among highly qualified personnel (HQP), facilitating their employment in industry; and focusing research investments on national priorities. The rationale for requiring that CHRP applications include Canadian partners is to ensure benefits to the Canadian health system as well as the Canadian economy directly stemming from the investment of Canadian public funds.

The purpose of the evaluation was to provide NSERC and CIHR senior management with a retrospective assessment of the relevance and performance of the program during the time period covered. The evaluation was also designed to ensure that NSERC and CIHR meet the requirements of section 42.1 (1) of the *Financial Administration Act* and the Treasury Board Secretariat's *Policy on Evaluation* (2009).

Multiple lines of evidence were employed to answer all evaluation questions, including a document review; administrative data review; file review; surveys with applicants, co-applicants, partners and HQP; and case studies. While the evaluation methodology benefitted from a quasi-experimental design (i.e., comparisons between funded and non-funded researchers), there was one important limitation: the results from the surveys of HQP and partners could not be used due to the low number of respondents.

Overall, the evaluation found that the CHRP program has been relevant, effective and efficient during the time period covered by this review.

Relevance

The evaluation found that the CHRP program aligns with NSERC, CIHR, and government strategic objectives and priorities in the areas of science and technology. The program is designed to help NSERC and CIHR to meet their mandates by supporting interdisciplinary and collaborative research and knowledge translation leading to health and economic benefits for Canadians. The CHRP program aligns with the Government of Canada's science and technology (S&T) strategy, under which the granting councils are encouraged to work together to support multidisciplinary research that brings together expertise from diverse fields, to

provide training opportunities for Canadians, and to encourage partnerships across various sectors.

The evaluation findings confirm the need for a program that funds collaborative research projects involving natural sciences or engineering (NSE) and health sciences. The findings from the survey of researchers suggest that the availability of other comparable funding sources is limited. The limited availability of other funding sources and the continued need for the program suggest that the program has filled a niche in the continuum of research funding programs in Canada. In fact, findings from the case studies suggested that there may be a perceived need for a stronger continuum of funding support for collaborative research involving both NSE and health researchers in the research community. Suggestions from interviewed researchers included bridging of CHRP research into larger granting programs provided by the two granting agencies and additional funding mechanisms that support research programs as well as knowledge translation and commercialization.

Effectiveness

The evaluation found that the CHRP program has been effective in meeting its outcomes pertaining to collaborations between NSE and health researchers, multidisciplinary research, as well as training of HQP.

The CHRP program has contributed to establishing new relationships between researchers (1.5 new relationships per project on average). Relationships between health and NSE researchers have also often been maintained following the completion of the projects (73%). These relationships were often sustained through subsequent research collaborations. A small portion of NSE researchers accessed CIHR funding, and a small portion of health researchers accessed NSERC funding for these subsequent research collaborations (16% and 17%, respectively). Researchers were satisfied with the quality of the collaboration with other co-applicants as well as the frequency of communication and processes for decision-making.

The CHRP program has made a considerable contribution towards addressing health-related issues through multidisciplinary research. The funded research generally achieved its intended, early-stage objectives (80%). Although the research was aimed at health benefits, researchers advised that longer-term outcomes do not occur for many years beyond the completion of the CHRP-funded research. Most projects (72%) produced at least one peer-reviewed article (5 on average). One-quarter (25%) of researchers reported that they had filed a patent application or had issued or were in the process of issuing a licence (14%) and 6% reported that their CHRP projects led to a spin-off company. CHRP researchers had generally implemented their knowledge transfer plan (69%), and one-half (54%) had transferred knowledge to knowledge/technology users. The relatively early-stage nature of the research and limited partner involvement appeared to be the main factors that limited knowledge transfer and partner use of research results. The multidisciplinary approach had ultimately been highly beneficial for addressing the research challenges at hand. The evaluation found examples of how it had improved both the quality of the research designs used and the results.

The low response rate to the HQP survey meant that the evaluation had to rely on the perspectives of funded and non-funded researchers, as well as anecdotal evidence from the case studies, to assess the program's impact on HQP. About 10 HQP per project received training opportunities as a result of the CHRP program. Researchers perceived HQP who participated in CHRP projects as significantly more likely to complete their degree, thesis or publication than HQP who participated in non-funded projects. The most important benefit to HQP was that they had an opportunity to broaden their expertise and gain multidisciplinary experience. A large majority of HQP were either working or in academic training, according to researchers.

While the program had achieved its outcomes, the evaluation found that CHRP projects were no more likely than projects that proceeded in the absence of CHRP funding to have impacts on researchers involved. This means that the availability of funding is more important than the source of funding, with the funding source having little to no impact on whether projects achieve outcomes. Funding opportunities provided by other organizations were, however, limited. Only 11% of non-funded projects could proceed (either in full or in part) without any support from NSERC or CIHR. Consequently, the CHRP program's key contribution is that it enables researchers to produce research that would not otherwise have been produced. In fact, one-half (50%) of non-funded projects did not proceed at all and one-quarter (26%) reported that their projects proceeded in part and slightly more than one in 10 (12%) that their projects proceeded in full. Out of projects that did proceed (either in part or in full) many had a reduced scope, often with less involvement of partners (44%) and HQP (46%).

Before the 2012 competition, the CHRP program was modified; the focus on potential impact and knowledge translation was increased through the requirement of having a partner involved in research projects (i.e., non-academic knowledge/technology user). The CHRP program was not designed to fund projects with significant involvement of partners prior to that. Therefore, the program's past performance should not be judged based on the extent to which funded projects have produced results that are relevant to and used by knowledge/technology users from the private, public and non-profit sectors. Data collected from researchers on partner impacts that the evaluation could collect should instead be used as baseline for future monitoring and evaluation. Researchers who involved partners primarily chose to work with partners because of their expertise (61%), and most researchers thought that the partnership was highly relevant to the project. According to researchers who had engaged partners, partners were involved in making facilities, equipment, services and material available to the research project (76%). CHRP partners were generally engaged in the different phases of the research project. The findings on partner involvement in CHRP projects could not, however, be validated with partners since very few completed projects involved partners and only partners who were listed in the funding applications were included in the survey sample, and 24% of researchers indicated that they engaged partners after the projects had commenced. Although many researchers (68%) perceived the research results as being at a stage where partners could use them, the evaluation could not draw conclusions on the relevance and use of research results by partners since partners who came onboard after the projects commenced could not be surveyed as part of the evaluation. Of the researchers who applied to the CHRP program before partner involvement became a formal requirement, one-half (50%) felt that their ability to find a

partner would inhibit them from applying for a CHRP grant. Barriers for involving industry partners, in particular, were highlighted in interviews with researchers and included the early-stage nature of the research and an absence of Canadian companies that could use the results. Interviewees did not highlight barriers related to involving partners from the public or voluntary sectors.

Economy, Efficiency, Design and Delivery

The CHRP program has been delivered in an efficient manner in that the administrative costs to deliver the program (an operating ratio of 5.3 cents for each dollar of grant funds awarded) are comparable to those of the NSERC Research Partnership Programs Directorate as a whole (5.5 cents).

Overall, researchers did not experience difficulties with the way that the CHRP program had been delivered. The two-stage application process was generally supported by researchers. The fairness and transparency of the application review process were subject to some criticisms, particularly from unfunded applicants, even though researchers generally admitted to knowing little about the structure of the current review panel. The most common concern of both funded and unfunded researchers was the amount and quality of the feedback on the Letter of Intent (LOI) stage. Researchers also recommended that program requirements related to the information knowledge transfer plan and inclusion of partners be relaxed and that grants be renewable.

Although there was sufficient performance information available to support the evaluation, further improvements could help ensure that contact information for all partners or HQP is available, that information on whether researchers primarily identify with NSERC or with CIHR is available and that applicant data can be shared between NSERC and CIHR in an efficient and timely manner.

Conclusions and Recommendations

Overall, the evaluation found that the program has been relevant, effective and efficient during the fiscal years 1999–2000 to 2008–09. The evidence examined suggests that the program has achieved both its immediate and intermediate outcomes pertaining to interdisciplinary research, interdisciplinary relationships, knowledge transfer and student training. A few recommendations are presented below.

Recommendation #1: Consider continued funding to collaborative health research involving health and NSE researchers through the CHRP program and further clarify and communicate the position of the program in the continuum of funding opportunities provided by NSERC and CIHR.

During the period under review, the CHRP program funded relatively early-stage research with a focus on generating collaborative, interdisciplinary research and training opportunities. Since the 2012 competition, a greater emphasis has been placed on producing tangible research results that can directly benefit Canada. While it was too early for this evaluation to look at the impacts of the changes to the program, the evidence presented in this report still supports the overall

notion that there is a need for a program that funds collaborative health research involving health and NSE researchers. The evaluation therefore recommends that the CHRP program should be continued, provided that funding interdisciplinary, collaborative research projects involving NSE researchers, health researchers and partners continues to be a priority for NSERC and CIHR. Considering the recent program changes, it is important that CIHR and NSERC assess, clarify and communicate the program's niche in relation to the agencies' other funding opportunities. The role of partners from the private, public and voluntary sectors should also be explicitly articulated in relation to the niche of the program. The case studies highlighted that the research community could benefit from increased clarity on the issue of program niche.

Recommendation #2: Make improvements to program design and ongoing performance measurement

a. Assess whether it is feasible to provide more substantial feedback on Letters of Intent (LOIs) to applicants

Researchers asked for more substantial feedback on their LOIs to help enhance the quality of their next submission (i.e., narrative reports from the peer reviewers as opposed to quantitative reports indicating only whether the LOI fulfilled certain criteria). Providing more qualitative feedback would, however, increase the burden on the peer-review committees, as the program receives a substantial number of LOIs.

b. Review the program's performance measurement strategy (including the logic model) to ensure that it effectively monitors the extent to which the CHRP program supports its new objectives, the impacts of the new partner requirements on the research community and program impacts on HQP

Since the 2012 competition, the CHRP program is placing a greater emphasis on partner involvement, knowledge transfer and use of research results. The program's performance measurement strategy and final project report templates should therefore be revisited to ensure that they can capture the two new outcomes in the program's logic model. When relevant, the indicators and data-collection instruments should be consistent with those used for measuring the impact of other NSERC and CIHR programs, to help facilitate further comparisons between programs.

The effect of the changes to the partner requirements on the research community and on research also need to be closely monitored to ensure that the changes have had the intended effect.

Both intermediate and long-term partner impacts could be captured through a partner follow-up survey administered a couple of years after the completion of the grant. To ensure that a survey sample of partners can be identified for future performance monitoring and evaluation, it is important that program staff collects information from researchers on which partners have *actually* been involved as part of the final project report and record this information in electronic format before the project file is closed. Electronic data-capturing of

applications and final reports has the potential to improve the efficiency of future evaluations and monitoring activities, as it would eliminate the need for manual data-entry. Similarly, contact information for HQP should be collected and recorded to ensure that HQP can be surveyed as part of the next evaluation.

c. Record information on whether researchers can be identified primarily as NSE or health researchers

It will be useful for the next evaluation to have explicit information on whether individual researchers can be identified primarily as NSE or health researchers. How the information will be collected and what criteria should be used will need to be determined. (If a self-identification approach is used, information can be collected from researchers in the application or the final reporting stage.)

d. Establish a protocol for sharing applicant, partner and HQP data between NSERC and CIHR

A protocol for the sharing of applicant data between CIHR and NSERC would help ensure that sufficient data is available to support the next evaluation of the program. For this evaluation, two ethics review boards required several months to determine what information CIHR would be able to share concerning applicants' funding history.

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1 INTRODUCTION

This report presents the key findings, conclusions and recommendations from the evaluation of the Collaborative Health Research Projects (CHRP) program conducted in 2011–12 to 2012–13. The evaluation covered the time period from fiscal years 1999–2000 to 2008–09. The Natural Sciences and Engineering Research Council of Canada’s (NSERC) Evaluation Division conducted the evaluation in collaboration with Circum Networks Inc., which conducted the surveys of funded and unfunded researchers.

The purpose of the evaluation was to provide NSERC and Canadian Institutes of Health Research (CIHR) senior management with a retrospective assessment of the relevance and performance of the program during the time period covered. The evaluation was also designed to ensure that NSERC meets the requirements of section 42.1 (1) of the *Financial Administration Act* and the Treasury Board Secretariat’s *Policy on Evaluation* (2009).

1.1 The CHRP Program

NSERC established the CHRP program in 1999. The program has provided support to natural sciences or engineering (NSE) researchers to work collaboratively with health researchers in novel research projects. In 1999–2000, the program objectives were to:

- focus on research that will lead to health benefits;
- translate the results of their research into improved health for Canadians;
- increase the ability of the NSERC community to integrate into the activities of CIHR; and
- train researchers in areas of NSE that translate into improved health for Canadians, more effective health services and economic development in health-related areas.

CIHR was established in 2000, close to the time of the launch of the CHRP program. Part of the rationale for the creation of the program was to integrate the activities of the NSERC and CIHR research communities. The program objectives have evolved slightly over time. Training of highly qualified personnel (HQP) became an explicit goal in 2001, when the program modified the last objective, above, to “train highly qualified people in collaborative research in the natural sciences and engineering that could potentially lead to improved health for Canadians.” The program’s expected results were further revised in 2002 and 2003, placing a greater emphasis on the program’s overall role in supporting collaborative research between health and NSE researchers rather than on transitioning NSE researchers into the newly established CIHR. Knowledge translation to end-users also became a focus, even though researchers were not required to include end-users as partners at that time. Specifically, between 2003 and 2011, the program aimed to:

- translate research results to end-users and stakeholders;
- encourage the NSERC and CIHR communities to collaborate and integrate their expertise in their novel research activities;
- advance interdisciplinary research leading to knowledge and technologies useful for improving the health of Canadians; and

- train highly qualified personnel in collaborative and interdisciplinary research of relevance to health.

CHRP funding was for up to three years in duration and ranged from fundamental knowledge creation to research on knowledge application relevant to industry or public policy.

While the evaluation was designed to cover only the time period fiscal years 1999–2000 to 2008–09, a description of how the program has evolved since then is provided below for context. In 2012, administration of the program was transferred to CIHR, and the participation of non-academic knowledge/technology users became a funding requirement. While involvement of knowledge/technology users or partners from outside the academic sector (e.g., private, public or voluntary sector organizations) had been strongly encouraged since 2001, it was not until the 2012 competition that it became mandatory. The partner requirements were changed in response to the launch of NSERC’s Strategy for Partnerships and Innovation (SPI) in 2009. The strategy aims to respond to the challenges faced by companies and researchers in connecting, partnering and effectively collaborating with each other. It is intended to build sustainable relationships between university researchers and partners; streamline partners’ access to NSERC’s programs; connect people and skills by encouraging industry-relevant skills development among HQP, facilitating their employment in industry; and focusing research investments on national priorities. The rationale for requiring that CHRP applications include Canadian partners is to ensure benefits to the Canadian health system as well as the Canadian economy directly stemming from the investment of Canadian public funds. In 2012, the program also dropped the requirement that CHRP projects must include a *new* research collaboration between a researcher in the NSE and a researcher in health sciences. This modification made the funding criteria more flexible in that the program could fund subsequent stages of research projects carried out by the same team of researchers. The current program objectives are similar to those adopted in 2003, but the third objective was revised in 2012, placing a greater emphasis on producing tangible research results that can directly benefit Canada: “Advance interdisciplinary research leading to knowledge and technologies with the potential to benefit Canada by improving the Canadian healthcare system and/or services and, where appropriate, lead to economic opportunities in Canada.” Table 1 presents annual competition statistics for the CHRP program. The application success rate averaged 25% from 1999 to 2008, and the average total grant size has increased somewhat over the years (from \$242,000 in 1999 to \$386,000 in 2008).

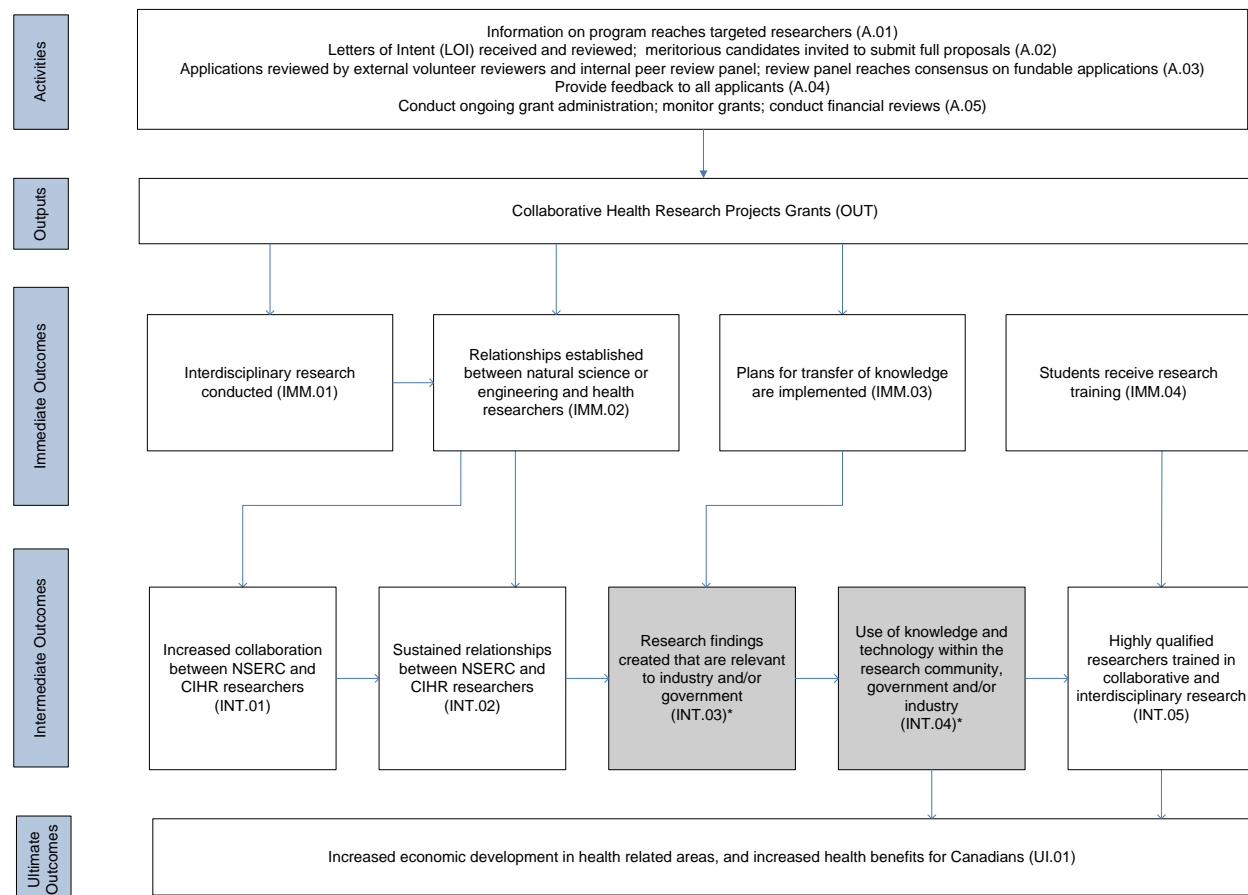
Table 1: Competition Statistics for CHRP (1999–2012)

Competition year	Letters of intent received	Full applications received	Awards	Letters of intent success rate	Full application success rate
1999	N/A	119	30	N/A	25%
2000	N/A	63	27	N/A	43%
2001	N/A	63	19	N/A	30%
2002	N/A	59	20	N/A	34%
2004	N/A	111	18	N/A	16%
2005	209	159	17	8%	11%
2006	237	54	18	8%	33%
2007	256	65	17	7%	26%
2008	298	100	34	11%	34%
2009	282	96	29	10%	30%
2010	326	112	31	10%	28%
2011	342	118	34	10%	29%
2012	516	149	37	7%	25%
Total	2,466	1,268	331	9%	26%

Note: Note that the competition moved from October to January in 2003, which is why this year is not included in the table. The competition year refers to the year when the funds were awarded. Letters of Intent were introduced in 2005.

The logic model (Figure 1) identifies the linkages between the activities of the CHRP program and its ultimate outcomes. It delineates the set of activities that make up the program and the sequence of outputs and outcomes that are expected to flow from these activities. The logic model serves as a “roadmap,” connecting activities to the ultimate outcomes, and thus identifies the steps that will demonstrate progress towards NSERC’s and CIHR’s expected results. Five levels of performance are delineated in the logic model: activities, outputs, immediate outcomes, intermediate outcomes and ultimate outcomes. It is important to note that the program was not designed to achieve the intermediate outcomes INT.03 and INT.04 until 2012, when the involvement of partners became a funding requirement.

Figure 1: CHRP Logic Model



* INT.03 and INT.04 were not adopted as program outcomes until 2012.

Activities and Outputs

The program activities, which are within the control of NSERC and CIHR staff, include:

- Publication and promotion of program for targeted researchers (A.01) – NSERC publishes a Program Guide for academic researchers that includes a program description and information on application procedures for CHRP as well as for other NSERC programs. A description of the program is available on the NSERC and CIHR websites, and is also promoted at NSERC and CIHR regional meetings and other events/activities.
- Letters of Intent (LOI) received and reviewed; meritorious candidates invited to submit full proposals (A.02) – interested parties submit a letter of intent that briefly outlines their proposed project. Selected applications that meet CHRP’s criteria as well as receive high support from reviewers are invited to submit full proposals.
- Applications reviewed by external volunteer reviewers and peer review panel (A.03) – The applications are reviewed by external experts as well as a peer review panel using the program selection criteria. Applications are rated using the 0 to 4.9 CIHR rating scale, and those with a final score of 3.5 or greater are eligible for funding.

- Feedback to applicants (A.04) – Successful and unsuccessful applicants receive feedback from the reviewers on areas of strength and weakness, as well as ways of improving their applications for future submission.
- Monitoring of CHRP grants (A.05) – Monitoring of the program consists of financial monitoring and measurement of program outcomes through a survey of awardees. Awardees are required to submit interim and final reports to NSERC.

The activities described above enable NSERC and CIHR to produce the program outputs: program material and CHRP awards.

Outcomes

The outcomes for the CHRP program are expected to occur at different points in time. It is important to note that the achievement of program outcomes rely on activities of and decisions made by awardees that are not under the direct control of NSERC and CIHR.

Immediate Outcomes

The immediate outcomes are a direct result of activities relating to the CHRP program and occur during the awardees' grant term. During this term, awardees conduct interdisciplinary research (IM.01). Through the process of conducting research, relationships are established between NSE and health researchers (IM.02), and plans for transfer of knowledge are in the early stages of implementation (IM.03). At the same time, HQP (e.g., students, research assistants, fellows) receive research training (IM.04).

Intermediate Outcomes

The intermediate outcomes are expected to occur following the conclusion of the CHRP grants. Relationships that develop between NSE and health researchers over the term of the research projects are expected to lead to increased collaboration (IN.01), and this in turn contributes to the sustainability of those relationships (IN.02). The collaboration between NSE and health researchers in conjunction with early plans for knowledge transfer is the key focus of the CHRP program. Collaboration and plans for knowledge transfer will help to ensure research findings that are relevant and useful to industry and/or public policy (IN.03), and increase the use of that knowledge and technology within the research community, government and/or industry (IN.04). The research training received over the term of the grant (IM.04) leads to highly qualified researchers/technicians trained in collaborative and interdisciplinary research (IN.05).

Ultimate Outcome

The ultimate outcome represents the long-term goal the program is attempting to achieve. Changes in policies and practices as a result of the use of CHRP research findings, as well as the increase in numbers of highly qualified researchers/technicians trained in collaborative and interdisciplinary research, will, over time, contribute to increased economic development in health-related areas and increased health benefits for Canadians (UI.01)

1.2 Evaluation Questions

The evaluation questions were derived first by drafting a set of key questions based on the core issues defined by the Treasury Board of Canada Secretariat's *Policy on Evaluation* (2009) and on input from NSERC and CIHR management (Table 2).

The program was not designed to achieve the *intermediate* outcomes covered by evaluation question 7 before 2012, when the involvement of partners became a funding requirement. Hence, the program's past performance cannot be judged on the basis of these outcomes. Looking at contributions in these areas to date could, however, establish a baseline from which future evaluations can measure the extent that new partner requirements have made a difference in the direction and use of research.

Table 2: Evaluation Questions

Evaluation Issues/Questions
<p>Relevance: The extent to which the CHRP program addresses a demonstrated need, is appropriate to the federal government, and addresses a demonstrable need</p> <ol style="list-style-type: none"> 1. To what extent does the CHRP program align with NSERC, CIHR, and government strategic objectives and priorities in the areas of science and technology (S&T)? 2. Is there a role for the federal government to fund the CHRP program? 3. To what extent does CHRP continue to address a demonstrable need? <ol style="list-style-type: none"> 3.1 What unique value does CHRP represent for natural science and engineering and health researchers?
<p>Design and Delivery: The extent to which the CHRP program is being administered and delivered in the intended manner</p> <ol style="list-style-type: none"> 4. What improvements, if any, should be made to the Review (A03) and Monitoring processes (A05)?
<p>Effectiveness: The extent to which the program is achieving or demonstrating progress towards intended outcomes</p> <ol style="list-style-type: none"> 5. To what extent has the program established long-term collaborative relationships between health and science researchers? (IMM.01, IMM.02, INT.01, INT.02) <ol style="list-style-type: none"> 5.1 What progress has the CHRP program made towards addressing health-related issues that require multidisciplinary collaborative research? (IMM.01) 6. To what extent are trainees gaining expertise, technical skills, and professional skills? (INT.05) 7. To what extent are CHRP-funded projects supporting the transfer of knowledge to end users/stakeholders? (IMM.03, INT.04) <ol style="list-style-type: none"> 7.1 To what extent are community/industrial partners involved in CHRP-funded research? (INT.03, INT.04) 7.2 To what extent have knowledge, technology and expertise been transferred to partner organizations (Canadian-based companies and/or government organizations)? (IMM.03, INT.04) 7.3 How relevant are the research findings to industry and/or government? How have community/industry partners used, and benefited from, university research results? (INT.03, INT.04) 7.4 What factors have limited or facilitated the transfer of results? (IMM.03, INT.04, INT.04)
<p>Efficiency and Economy: CHRP resource utilization in relation to the production of outputs and progress toward intended outcomes</p> <ol style="list-style-type: none"> 8. To what extent is the CHRP program being delivered in an effective and efficient manner? (A01-A05) <ol style="list-style-type: none"> 8.1 Can the efficiency of the CHRP program be improved (i.e., can program outputs be achieved in a more affordable manner)? (A01-A.05)

1.3 Design and Methods

A quasi-experimental design (with non-equivalent groups) was used for estimating the impacts of the CHRP program. Researchers who had applied for, but not received, a CHRP grant were used as a comparison group.

Document Review

The document review provided background and context for the interpretation of results and informed evaluation questions related to relevance and to efficiency and economy. A range of

documents was reviewed, including but not limited to program descriptions, the program logic model, financial information, reporting templates, application forms, and documents related to the peer-review process.

Administrative Data Review

Administrative data on all researchers from NSERC's Award Management Information System (NAMIS) was used to provide contextual information for the evaluation.

File Review

The purpose of the file review was to help support a number of evaluation questions. The file review was carried out by NSERC evaluation staff and extracted data from final reports with an end-date between fiscal years 1999–2000 and 2007–08. A typical grant file contained the grant application, letters of support, a final report from the principal investigator, a "file closed" report completed by NSERC staff, and a statement of account. A total of 145 final project reports and file closed reports were included in the review.

Online and Phone Surveys

Web surveys were designed to provide quantitative and qualitative data to address a number of evaluation questions, in particular those pertaining to the program's immediate and intermediate outcomes. The following groups associated with projects completed between fiscal years 1999–2000 and 2008–2009 were surveyed:

- *Funded researchers* – CHRP applicants and co-applicants were surveyed online. If the applicant or co-applicant had received funding for more than one CHRP project, the survey pertained to their earliest funded project.
- *Non-funded researchers* – Unsuccessful applicants and co-applicants were also surveyed online. If the applicant or co-applicant had applied for CHRP funding more than once, the survey pertained to their earliest unfunded project. If the applicant or co-applicant had been both successful and unsuccessful in receiving CHRP funding, they were surveyed as "funded researchers."
- *Funded partners* – A phone survey of partners that were identified in funded CHRP applications was administered. Contact information for partners who came onboard after the project had commenced was unfortunately not readily available. One key representative from each organization that partnered with CHRP funded researchers was surveyed.
- *Highly qualified personnel (HQP)* – undergraduate students, graduate students, PhD students, postdoctoral fellows and research staff who had participated in a CHRP project were invited to an online survey.

The survey response rates for funded researchers and non-funded researchers were acceptable considering the survey mode and the fact that researchers were being asked to respond to questions about projects that had been completed many years ago (Table 33). The response rate

was predictably higher for funded researchers than unfunded researchers. The 113 applicants and co-applicants who responded to the survey represented 58 unique projects,¹ and the non-funded researchers represented 130 unique projects.

Among the 113 funded researchers who responded to the survey, applicants were over-represented in that they constituted 50% of the respondents, but only 28% of the population. The higher response rate among applicants (i.e., 43% compared to 19% among co-applicants) is not surprising considering that applicants are more involved than co-applicants. Applicants and co-applicants were treated as one group for the purpose of the analysis. Weighting was used to correct for under-representation of co-applicants as well as non-funded researchers among respondents. The report therefore presents the weighted number of cases. They differ from the unweighted number of cases shown in Table 3.

The results from the surveys of HQP and partners could not be used because of the low number of respondents. Due to privacy issues, NSERC does not have access to contact information for HQP who participate in grants programs. A respondent-driven sample was therefore employed in which researchers were asked to forward a survey invitation and a subsequent reminder to HQP. Despite the fact that this approach had been successfully used for other similar evaluations in the past, only 20% of researchers who responded to the survey forwarded the invitation to HQP. The challenge was likely that the projects had commenced many years ago and the researchers may no longer be in touch with the HQP.

Table 3: Survey Response Rates

	Funded researchers	Non-funded researchers	Partners	HQP
Population	416	794	17	371 (estimate)
Sample	416	794	16	371 (estimate)
Responses	113	118	5	8
Response rate	27%	15%	28%	2% (estimate)
Sample error	±6.7%	±7.7%	±30.9%	±33.9%

Note: The HQP population was estimated based on the total number of projects the researcher population represented and the average number of HQP per project reported in grantees' final reports (i.e., 116×3.2). The partner that participated in a mini case study was excluded from the survey sample to reduce response burden.

Pearson's chi-square and analysis of variance (ANOVA) were used to examine differences between funded and non-funded researchers when appropriate. Instances in which important statistical differences were found are highlighted in the report. The HQP and partner surveys could not be used as a line of inquiry in the evaluation because of the low response rate. The

¹ The 58 projects represented half (50%) of the 116 projects sampled for the survey after duplicates were removed.

implications of this on the evaluation's ability to assess the performance of the program are further discussed in the strengths and limitations section.

Mini Case Studies

Mini case studies were conducted to provide a more in-depth understanding of the outcomes of CHRP-funded projects from the perspective of researchers, partners and HQP. Only projects that were considered successful in terms of research results, collaborations and knowledge translation were selected in order to provide an understanding of what CHRP projects' success means. The projects were also selected to ensure some variation in discipline, research topic areas, project size (i.e., funding amount), year of completion and geographical location. Given the budget constraints of this evaluation, it was decided that five small-scale case studies would serve the evaluation design better than fewer, in-depth case studies. The case studies drew on information gathered as part of other lines of inquiry as appropriate. Semi-structured interviews were also conducted with 12 researchers, one partner and two HQP. An attempt was made to select projects that had involved partners, but the partners consulted claimed to have little knowledge of the project, and only one partner with limited involvement was interviewed in the end. As noted, few partners had been involved in CHRP projects, and it was difficult to track down and establish contact with HQP for the purpose of the case studies.

Strengths and Limitations

The quasi-experimental design and scope of the evaluation were comprehensive, considering that the program was rated as low-risk in NSERC's departmental evaluation plan, based on the materiality of the program.

The evidence supporting the assessment of HQP training and employment outcomes would have been stronger if the survey response rate from HQP were higher. The evaluation was therefore reliant on researchers to forward an invitation asking HQP to complete the survey. In the absence of HQP survey results, the evaluation was reliant on information provided by researchers and partners to assess impacts on HQP, even though some researchers may have had limited first-hand knowledge of these impacts. Considering that the CHRP program is a low-risk program and that the program places a somewhat higher importance on research impacts relative to HQP impacts, this mitigating strategy was deemed sufficient.

While survey data would have made the assessment of use and impact of research results stronger, the program was not designed to contribute to these outcomes during the time period covered by the evaluation. Consequently, the absence of partner survey results did not significantly impede the evaluation's assessment of the program's performance during this time period. It will, however, be very important to capture the partner perspective as part of the next evaluation.

Another limitation of the evaluation design was that it used a non-equivalent comparison group. Non-funded researchers² comprised a non-equivalent comparison group because their projects were ranked lower than funded projects by the peer review panels. This means that if funded researchers would report to have achieved outcomes to a higher extent than non-funded researchers, the difference in responses could be the result of inherent quality differences between projects rather than the fact that some received funding from the CHRP program.³ On the other hand, about half of the researchers who constituted the comparison group were associated with projects meritorious enough to be granted funding from other sources in the absence of CHRP funding. In addition, the comparison group used for assessing program *effectiveness*, in particular, included only researchers who had accessed alternative funding sources for their projects. Considering this, it seemed worthwhile to use non-funded researchers as a comparison group.

² The comparison group included both researchers associated with projects that had been classified as fundable (i.e., projects that were not funded due to the limited program grant budget) and non-fundable (i.e., projects that were not meritorious enough to be given funding) by the peer review panel.

³ In the end, the CHRP projects were no more likely than non-funded projects to have demonstrated impacts overall. This means that the risk of over-estimating the impact of the CHRP program due to a non-equivalent comparison group was less of a concern than initially anticipated.

2 KEY FINDINGS – RELEVANCE

Question 1: To what extent does the CHRP program align with NSERC, CIHR, and government strategic objectives and priorities in the areas of science and technology (S&T)?

The CHRP program contributes both to NSERC’s strategic outcome 3.0 Innovation, “productive use of new knowledge in the natural sciences and engineering,” and CHIR’s strategic outcome “a world-class health research enterprise that creates, disseminates and applies new knowledge across all areas of health research,” as it is designed to promote collaborative relationships between natural sciences or engineering and health researchers as well as the private, public and voluntary sectors, and contribute to transfer and use of knowledge. Similarly, the CHRP program’s focus on interdisciplinary research with involvement of partners also aligns with priorities laid out in the Government of Canada’s science and technology (S&T) strategy, *Mobilizing Science and Technology to Canada’s Advantage*.⁴ The S&T strategy identifies health and related life sciences and technologies as a priority area in which the granting councils “will work together to build a critical mass of expertise.” The federal government’s expectation that the “councils will support multidisciplinary research that brings together expertise from diverse fields” further coincides with CHRP’s objective to facilitate the production and use of new knowledge in the health sciences through collaboration with natural sciences or engineering researchers.

Conclusions: The CHRP program aligns with NSERC, CIHR, and government strategic objectives and priorities in the areas of science and technology, including the S&T strategy in which the granting councils are encouraged to work together to support multidisciplinary research that brings together expertise from diverse fields, to provide training opportunities for Canadians and to encourage partnerships across various sectors.

Question 2: Is there a role for the federal government to fund the CHRP program?

The S&T Strategy (Government of Canada, 2007) states that the role of the federal government in research and development (R&D) is to encourage private-sector S&T investment, fund university and college R&D, undertake science and technology work, and foster national and international partnerships. NSERC and CIHR jointly fulfill a central part of that role in supporting academic research, promoting partnerships between sectors, and developing the next generation of qualified and talented scientists and engineers:

NSERC’s role is to make investments in people, discovery and innovation to increase Canada’s scientific and technological capabilities for the benefit of all Canadians (NSERC, 2012).

⁴ Canada’s New Government. *Mobilizing Science and Technology to Canada’s Advantage*. Ottawa: Author, 2007.

[The mandate of the Canadian Institutes of Health Research (CIHR) is to] excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge and its translation into improved health for Canadians, more effective health services and products and a strengthened Canadian health care system (CIHR, 2012).

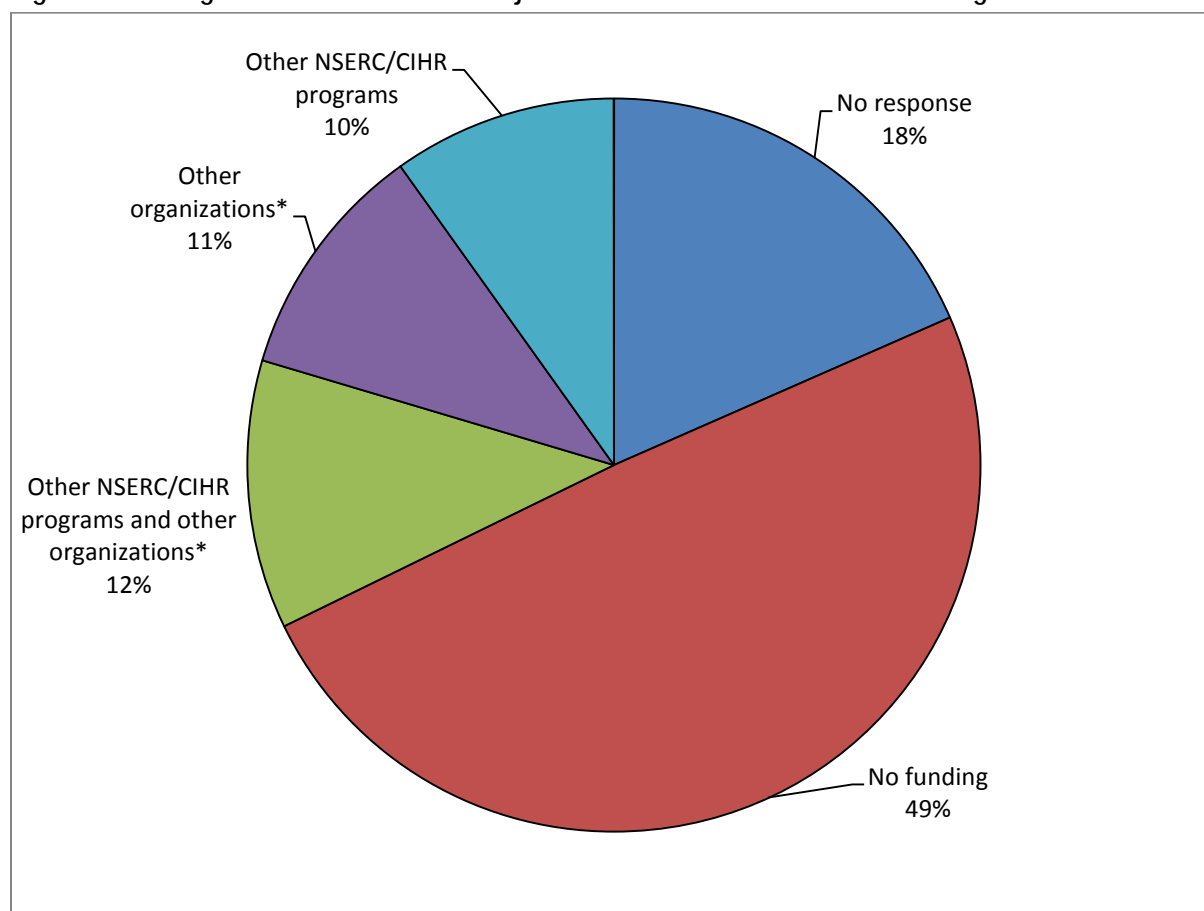
As discussed in the previous section, the CHRP program contributes to both NSERC's and CIHR's mandates.

An assessment of the federal government's role in delivering a program typically includes a comprehensive assessment of whether other non-federal programs duplicate the program. A full review of other, non-federal programs was, however, not conducted as part of this evaluation. The reason is that it is unlikely that program overlaps exist on the national level. NSERC and CIHR have unique positions in Canada as the sole federal providers of research funding to NSE and health research. The risk associated with not spending evaluation resources on identifying overlaps between CHRP and non-federal programs on the national level was therefore deemed as low. The availability of other funding sources was, however, explored briefly as part of the researcher surveys and case studies.

While just over half of the applicants (53%) did not perceive the CHRP program as the only funding opportunity for collaborative projects involving NSE and health science, survey findings show that similar funding opportunities were, in fact, scarce; it was rare that researchers could rely on financial support from organizations other than NSERC and CIHR in the absence of CHRP funding. Figure 2 shows that only 11% of unfunded researchers proceeded with their project (either in full or in part) without any support from NSERC or CIHR (i.e., other federal funding programs, industrial partners, provincial government, and non-profit organizations). A similar proportion (12%) received support from both the agencies and other sources. The absence of funding opportunities that overlapped with the CHRP program was further supported by the fact that more than two-thirds (68%) of the non-funded researchers who were able to find financial support for their projects had to alter the scope or focus of their project to secure alternative funding (see evaluation question 5.1, Figure 4). If significant funding opportunities that duplicated the CHRP program existed, a higher proportion of projects would likely have proceeded without further modifications.

Researchers interviewed as part of the case studies generally perceived the CHRP program to have a unique position as a funding source for collaborative research involving NSE and health researchers. Their insights on this topic are further discussed in the next section.

Figure 2: Funding Sources for Research Projects that Did Not Receive CHRP Funding



Source: Researcher survey (weighted n = 152)

* Other sources include federal funding programs, industrial partners, provincial governments and non-profit organizations.

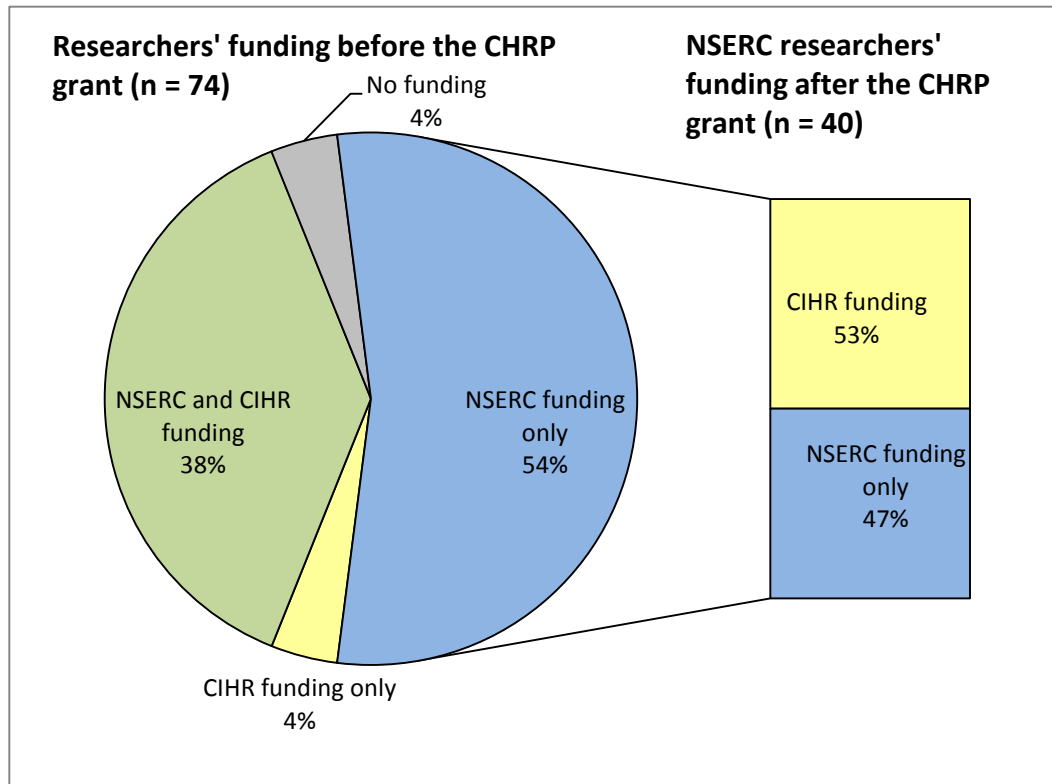
Conclusions: The CHRP program is designed to help NSERC and CIHR meet their mandates to support interdisciplinary and collaborative research and knowledge translation leading to health and economic benefits for Canadians. The evidence available suggests that the availability of other similar funding sources is limited.

Question 3 and 3.1: To what extent does CHRP continue to address a demonstrable need? What unique value does CHRP represent for natural science and engineering and health researchers?

During its early years (1999–2001), one of the goals of the CHRP program was to fill a niche in NSERC's and CIHR's continuum of research funding programs by transitioning NSE researchers into the newly established CIHR. In 2005, CHRP program staff conducted a study to assess if the program had been effective in meeting this objective. The study looked at funding patterns of 74 researchers who had received a CHRP grant in 1999–2002. The study found that 38% of the researchers who were awarded a CHRP grant had already received grants from both funding agencies in the past and more than half (54%) had received only NSERC funding (Figure 3). The remainder had received only CIHR funding (4%) or no funding at all (4%).

Among the 40 researchers who had received only NSERC funding⁵ in the past, 45% had been awarded a CIHR grant after their CHRP grants, either as an applicant or co-applicant. This suggests that the program was at least somewhat effective in strengthening NSERC researchers' liaison with CIHR, even though it is important to note that the movement from NSERC to CIHR may have occurred as a result of the establishment of CIHR in 2000 rather than the establishment of the CHRP program. Considering that the program's focus changed in 2001, additional evaluation resources were not spent on exploring this issue further.

Figure 3: Researchers' Funding Sources Before and After the CHRP Award



Source: Program data

Since 2001, the CHRP program's niche has been to provide funding to address research problems that require participation from both NSE and health researchers. Both NSERC and CIHR have had programs that support collaborative research projects, but these programs have not funded multidisciplinary collaboration between health and NSE researchers. NSERC's Strategic Project Grants funds early-stage research involving partners, but Strategic Grants are restricted to NSE target areas and, while co-applicants in non-NSE disciplines can receive up to 30% of the grant, this does not apply to researchers in health sciences. Similarly, if an application with a health component is submitted to NSERC's Collaborative Research and

⁵ Information on whether the researchers had received funding from CIHR's predecessor, the Medical Research Council of Canada, was not readily available.

Development program, which funds collaborative research projects with a required cash contribution from partners, NSERC would only ever fund the NSE component of that project. The applicant would be required to identify additional funding elsewhere to cover the health component. Similarly, CIHR's Industry-Partnered Collaborative Research Operating Grant funds collaborative research projects involving the academic community and Canadian industry partners, but only in the health fields.

The two previous sections pertaining to evaluation questions 1 and 2 highlighted the facts that the Government of Canada has identified a clear need for collaborative, multidisciplinary approaches in its S&T strategy and the evidence available suggests that the availability of other similar funding sources is limited. The high number of LOIs received (see Table 1), findings from the surveys of researchers, and interviews with researchers reiterate that there is a strong demand and perceived need for the program. Both funded and non-funded researchers surveyed agreed that funding of collaborative research involving NSE and health sciences fulfills an important need (average of 6.2 and 5.7 on a 7-point extent scale) and that the program is well designed to address that need (average of 5.0 and 4.0 of 7). The need for the program was reiterated in that all researchers interviewed as part of the case studies applied to CHRP multiple times, and, in all cases, the proposed projects represented subsequent stage(s) of their initial CHRP grant. For them, CHRP was the only funding source for collaborative research involving NSE and health researchers. One researcher stated that the CHRP program "fills a huge gap between health research and engineering research," and stated that he and his research team "would never be where [they] are today if it [hadn't been] for that program." This researcher had been told that his project was too engineering-focused when he applied for funding from CIHR and that it was too clinically focused when he applied for funding from NSERC. Overall, one in five (20%) funded researchers who received funding over the period 1999 to 2008 reapplied at least once.

Comments from researchers interviewed as part of the five case studies suggested that there is a need for an even stronger continuum of funding support for collaborative research involving both NSE and health researchers, rather than just a single program that funds project-based research. Some suggested that the granting agencies should help bridge CHRP research into larger granting programs provided by the two granting agencies, while others wanted to see funding mechanisms that supported research programs. A couple of researchers interviewed suggested that there also should be a funding mechanism for subsequent stages of research when it was possible to move into knowledge translation and commercialization.⁶ One researcher interviewed explained that such a mechanism would be an important complement rather than a substitute to the CHRP program: "[T]he knowledge translation/commercialization piece is an add-on to successful research, and not the starting point for successful research." Another researcher pointed out that, while it is very difficult to get industry to invest money,

⁶ It is unclear whether these researchers were aware of NSERC's Idea to Innovation (I2I) program and CIHR's Proof of Principle (PoP) program.

they wanted to have the possibility of matching the industry funds with a good ratio if the opportunity came up.

Conclusions: The evaluation findings confirm the need for a program that funds collaborative research projects involving NSE and health sciences. The limited availability of other funding sources and the continued need for the program suggests that the program has filled a niche in the continuum of research funding programs in Canada. In fact, findings from the case studies suggested that there may be a perceived need for a stronger continuum of funding support for collaborative research involving both NSE and health researchers in the research community. Suggestions from interviewed researchers included bridging of CHRP research into larger granting programs provided by the two granting agencies and additional funding mechanisms that support research programs as well as knowledge translation and commercialization.

3 KEY FINDINGS – DESIGN AND DELIVERY

Question 4: What improvements, if any, should be made to the review and monitoring processes?

In 2006, a pre-selection process was introduced to the CHRP program, requiring applicants to submit an LOI to announce their interest in submitting a full application. For the period 2006 to 2008, there were 1,000 LOIs, of which 371 (i.e., 37%) submitted full proposals, resulting in 86 funded projects. Results of the researcher survey indicated that both funded and unfunded researchers appreciated this two-stage application process (78%). However, some researchers raised concerns about the lack of feedback. They advised that more detailed feedback is needed at the LOI stage to help enhance the quality of their research application. One researcher explained,

I understand the need for the LOI stage given the large number of applications; however, using check boxes with a binary yes or no response for conditions to be met, and then little to no feedback on the proposed work...means too little information coming back for unsuccessful applicants on how to improve their grant.

The time and effort required to prepare a CHRP funding application was reasonable to a majority of funded researchers (67%), but generally not to applicants who did not receive funding (36%).

It is unclear to what extent applicants received feedback on their applications. Just over half of funded researchers (60%) and unfunded researchers (55%) indicated that they had received feedback, but relatively few said that they had not (10% of funded and 21% of non-funded). The rest were unsure or chose not to answer the question.

Among the funded researchers who had received feedback on their applications, 67% were satisfied with the quality of the feedback and 11% were unsure. Only 17% of non-funded researchers were satisfied with the quality of that feedback and 21% were unsure.

Three-quarters (75%) of funded researchers and nine in ten (91%) non-funded researchers indicated that they were unfamiliar with the structure of CHRP's current review panel. Despite being unfamiliar with the structure, 46% of all applicants perceived the review process as transparent and 66% had confidence in the program's assessment of research proposals in their field. Not surprisingly, non-funded researchers (38%) were significantly less likely than funded researchers (61%) to perceive the application review process as transparent ($p < 0.01$). Non-funded researchers also had significantly less confidence in the program's assessment of research proposals in their field (24% compared to 50%, $p < 0.01$).

The CHRP program's reporting requirements were generally viewed as similar to those of other programs by grantees (69%) and as reasonable considering the amount of funding received (71%).

Although there was sufficient performance information available to support the evaluation, some issues related to the monitoring process became apparent during the course of the evaluation. First, contact information for partners who came onboard after the project had commenced, as well as for HQP who had participated in funded projects, was not readily available. Future evaluations, as well as ongoing monitoring, would be in a better position to assess the program's impact on students and partners if contact information were collected as part of ongoing monitoring. Lessons learned from this evaluation suggest that asking researchers to forward survey invitations to these groups may not lead to high enough response rates. Second, it would also have been useful if information on whether researchers primarily identified with NSERC or with CIHR were collected in the application or final reporting stage. Third, there was no data sharing protocol for applicant data between NSERC and CIHR. This caused delays in the evaluation, as two ethics review boards required several months to determine what information CIHR would be able to share with NSERC.

Conclusions: Researchers generally supported the two-stage application process, but the perceived fairness and transparency of the application review process were subject to some criticisms, particularly from unfunded applicants, even though researchers generally admitted to knowing little about the structure of the current review panel.

The most common concern of both funded and unfunded researchers was the amount and quality of the feedback on their LOI. Researchers did not call for any changes to the program's monitoring process.

Although there was sufficient performance information available to support the evaluation, further improvements could help ensure that contact information for all partners or HQP is available, that information on whether researchers primarily identify with NSERC or with CIHR is available and that applicant data can be shared between NSERC and CIHR in an efficient and timely manner.

4 KEY FINDINGS – EFFECTIVENESS

Question 5: To what extent has the program established long-term collaborative relationships between health and science researchers?

The evaluation looked at how common it was that CHRP projects helped to establish new relationships between researchers, what these relationships looked like during the project, as well as how common it was that NSE and health researchers engaged in subsequent collaborations beyond the end of their CHRP grant.

Relationships Between Researchers During the Grant

Each CHRP grant engaged an average of 3.6 researchers, of which 2.6 were co-applicants. The survey results revealed that a majority of CHRP researchers (80%) had established new relationships with an average of 1.5 researchers as a result of their project. Only one-fifth (20%) of researchers reported that the CHRP grant did not generate any new relationships with other researchers. Survey results did not provide sufficient detail to be able to determine what proportion of new relationships had been developed between researchers in health and NSE disciplines. The case studies provided both examples of researchers who had formed new collaborative relationships and researchers who had engaged the same researchers multiple times. Several principal investigators said they had obtained multiple CHRP grants and they had brought on different researchers from different disciplines for different grants depending on the needs of the research challenge at hand. Collaborative relationships between health and NSE researchers were sometimes established by chance. In two cases, the researcher had met a co-applicant at a workshop/conference and, in another case, on an airplane. One of the researchers explained that there are limited opportunities for researchers to meet and discuss ideas for conducting multidisciplinary research.

Researchers described the communication among the university researchers on the project as frequent (80%), reporting that research team meetings typically happened every few weeks (41%), or less frequently (26%). Decisions were generally made collectively or in an inclusive manner (79%).

Overall, the majority of funded researchers considered their research collaboration with their co-applicants to have been a success (81%). Researchers were asked to rate their satisfaction with the quality of different aspects of the collaboration on a five-point scale from inadequate (1) to excellent (5). The highest-rated aspects were acceptance of new ideas (4.5) and the involvement of collaborators from other disciplines (4.4). Other aspects of the collaboration were also rated high, including the overall productivity of the collaboration (4.3), resolution of conflicts among co-applicants (4.2), knowledge translation (e.g., papers, patents, new processes, practices) (4.2), and communication among co-applicants (4.1).

Collaborations Between Co-applicants Following the Grant

Researchers maintained relationships with 1.1 researchers from the other granting agency on average. Most relationships with co-applicants were sustained through research collaborations (78%). A majority of researchers who had engaged in subsequent research collaborations (90%) indicated that they were at least somewhat attributable to the CHRP grant. Some relationships were also sustained through informal networks (29%) and formal networks (20%). Overall, out of researchers who had maintained relationships, either through research collaborations or through other means, a majority (69%) attributed those relationships to the CHRP grant to at least some extent. Only about one-quarter of researchers (27%) did not maintain any relationship beyond their CHRP project. The most common reason why researchers had not maintained relationships beyond their project was that further opportunities to work together had not arisen (30%).

Subsequent research collaborations were most often funded by the researcher's home granting agency (i.e., the granting council the researcher primarily identified themselves with). Table 4 shows that slightly more than half of NSERC researchers (53%) received support from NSERC and slightly less than half (46%) of CIHR researchers received support from CIHR. A small portion of researchers received support from the other granting council (16% of NSERC researchers and 17% of CIHR researchers).

Table 4: Sources of Funding for Subsequent Research Collaboration

	NSERC researchers (weighted n = 32)	CIHR researchers (weighted n = 24)	Overall (weighted n = 56)
NSERC grant(s)	53%	17%	38%
CIHR grant(s)	16%	46%	29%
Federal government grant program	28%	13%	23%
Provincial government grant program(s)	28%	17%	23%
Industrial partner(s)	19%	21%	21%
Non-profit organization(s)	12%	4%	9%
Other	13%	25%	20%
Don't know/ Prefer not to answer	6%	21%	12%

Source: Researcher survey
 Note: Respondents could choose more than one source of funding when answering the question.

The researchers who received subsequent funding from the other granting agency were asked to identify the specific program from which they had received funding. Four of the five NSERC researchers who received support from CIHR did not indicate which specific program the funds came from, and one was funded by CIHR's Open Operating Grants program. Similarly, two out of four CIHR researchers who received support from NSERC did not specify which program they had received funding from. The rest had received funding from the Strategic Network

Grants program, the Collaborative Research and Development Program and the Industrial Research Chair program.

One of the researchers interviewed as part of the case studies stated that his first CHRP grant had enabled the research team to participate as collaborators on two other CIHR-funded projects in the field of health informatics.

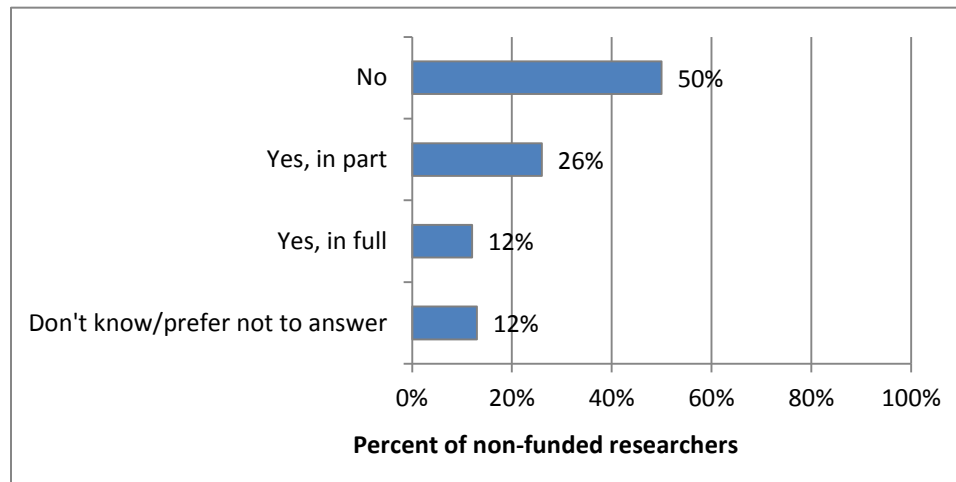
Conclusions: The CHRP program contributes to establishing new relationships between researchers and maintaining relationships between health and NSE researchers following the completion of their project. Relationships were most often sustained through subsequent research collaborations. A small portion of NSE researchers accessed CIHR funding, and a small portion of health researchers accessed NSERC funding for these subsequent research collaborations. Researchers were satisfied with the quality of the collaboration with other co-applicants as well as the frequency of communication and processes for decision-making.

Question 5.1: What progress has the CHRP program made towards addressing health-related issues that require multidisciplinary collaborative research?

From 1999 to 2008, approximately \$64 million was awarded to 200 CHRP projects. CHRP projects produced an average of five peer-reviewed articles according to the final project reports. The large majority of projects (72%) resulted in at least one peer-reviewed article.

The survey findings show that, if the CHRP program did not exist, many of these projects would not have proceeded or would have been reduced in scope. One-half (50%) of non-funded researchers advised that their proposed projects did not proceed in the absence of funding, one-quarter (26%) reported that their projects proceeded in part and slightly more than one in 10 (12%) said that their projects proceeded in full (Figure 4). Similarly, slightly more than four in 10 funded researchers (43%) believed that their project would not have proceeded if they had not received the grant.

Figure 4: Research Proceeding in Absence of CHRP Funding



Source: Researcher survey (weighted n = 152)

Researchers whose project proceeded in the absence of CHRP funding, either in full or in part, were asked how their project differed from the project proposed in their CHRP application. The most frequently cited difference was reduced scope of the research design or model (55%) and reduced involvement of HQP (46%) or partners (44%). Relatively few researchers had reduced the field work (28%) or modified the subject area (15%). Almost half of researchers also stated that their project (46%) took a longer time to complete.

According to CHRP final reports, the majority of research projects (82%) achieved all or more than half of their intended objectives. Results of the file review and survey highlighted the fact that the objectives of the CHRP projects were more focused on knowledge creation than partner uptake and use. The most common project objective was to increase the knowledge base and transfer the new knowledge to other academic researchers (80%), which also was achieved in most cases (79%), according to surveyed researchers. All five projects looked at as part of the case studies had reached their research objectives even though subsequent stages or research and development would be necessary before the research results could be applied. Examples of research results produced include:

- Improvement of diagnostic techniques for patients suffering from atherosclerosis through the development of new imaging methods for detecting risk factors of acute heart attack and cerebral stroke.
- Development of a non-invasive procedure for assessing inflammatory gum disease, which uses light to measure vibrations between the chemical bounds as radiation passes through them.
- Reduction of patient risk during anaesthesia (and reduced cognitive burden on the part of the clinician during monitoring) by applying the same methods that are used to indicate faults in engineering processes to the problem of patient monitoring.
- Investigation of ways in which video-based technology using a digital platform (e.g., computer or digital device) can enhance gesture-driven communication for children

with temporary speech loss which resulted in a non-contact communication aid that is configurable to individual communication needs.

- Development of more effective treatments for breast cancer by exploring the combination of key immune-mediated agents.

The case study findings highlighted the fact that the research conducted had been early-stage. One researcher explained that, although his team had achieved all of their intended outcomes, there was still considerable work to be done:

This diagnostic technology required further work beyond the initial CHRP grant – further development, regulatory approval, and marketing – in order to demonstrate its diagnostic and prognostic efficacy...[and] the initial CHRP grant was the first step.

Several researchers thought that a three-year CHRP project cannot be expected to achieve the longer-term benefits aimed at improved health; considerable developmental and clinical testing, regulatory approval, and marketing are required beyond the end of the three years in order to bring the technology to the stage of commercialization. One researcher explained that

although the objectives [of the initial CHRP project] were met, those results represented a solution to a couple of pieces of the puzzle, there still remains much work to be done before achieving the longer-term objectives of reducing patient risk during anesthesia.

CHRP projects appeared to lead to further research in the same area. In their final reports, almost all grantees (96%) indicated that the CHRP project had provided them with new research opportunities, and slightly less than half had changed the direction of their research as a result of the grant (42%). One researcher interviewed as part of the case studies explained, “That initial CHRP grant paved the way for future studies that were more important as they built on what [the research team] developed.” While follow-up research was undertaken by grantees, subsequent research projects tended to be early-stage as well. For example, one researcher had received two CHRP grants for continued work in the same area. The latter grant involved validation of the technology developed; however, considerably more research would be required before health benefits could be achieved. The researcher stated that “important next steps involve assessment of the disease progression longitudinally, and that is beyond what could be accomplished with a CHRP grant.”

The perceived need for a multidisciplinary approach was discussed in Section 1. The case studies further highlighted that the multidisciplinary approach had ultimately been highly beneficial for addressing the research challenges at hand. One researcher interviewed explained,

If I were not collaborating with anyone, I might think I understand what is at the leading edge of [health] research, but really I wouldn't know because I'm not a [health] researcher; I haven't spent my entire life understanding [the field]. We can publish very high impact papers because we're asking the most important questions.

Each of the two laboratories contributed its own expertise to the research and allowed the team to produce very high-quality results. Another example of how the CHRP project had offered the researchers involved an opportunity to draw on each other's areas of expertise to conduct clinical validation was provided by a different case study:

When the project started, it was challenging because it was not obvious how to delineate each other's responsibilities and minimize overlap. For example, [the engineering researcher] knew a lot about computer algorithms, software developments, biomedical engineering; however, these were not familiar to [the health researcher]. On the other side, [the health researcher] had knowledge of the clinical aspects of the project than did [the engineering researcher]. The two researchers consequently learned from each other, sharing their knowledge in areas such as formulas, software and clinical applications.

Another researcher interviewed for a different case study also described how team members had gained an increased understanding of how different disciplines can work together to solve a research problem at hand:

Working within a multidisciplinary team meant that technology experts gained a better understanding of the pathogenesis and biochemical aspects of the disease, and had better access to test subjects and patient prognosis; the clinicians on the other hand gained an understanding of how spectroscopy could be applied to physiologic and pathologic conditions.

In this case, the interdisciplinary research collaboration had resulted in a tool design that could best meet the needs of clinicians and patients. According to one of the researchers involved, the collaboration moved the research closer to "a real life translatable project" than would have been possible if researchers from only one discipline were conducting the research.

While the multidisciplinary team had been a real asset, the case studies also revealed that it had often been challenging for health and NSE researchers to find a common language. The amount of work and time required to learn another language and culture was described as "a huge investment and risk." In two cases, it had taken a year before the team could start working effectively together. The case studies suggested that a shared passion for the same area of research, personal compatibility and someone on the research team taking on the role of "translating" between disciplines had helped overcome these challenges.

Conclusions: The CHRP program has made a substantial contribution towards addressing health-related issues through multidisciplinary research. The funded research generally achieves its intended, early-stage research objectives. Although the research was aimed at health benefits, researchers advised that longer-term outcomes do not occur for many years beyond the completion of the CHRP-funded research. The multidisciplinary approach had ultimately been highly beneficial for addressing the research challenges at hand. The evaluation found examples of how it had improved both the quality of the research designs

used and the end results.

Without the program, approximately half of the researchers would not have proceeded with their project, and many of those who did proceed with their project would have reduced it in scope.

Question 6: To what extent are trainees gaining expertise, technical skills, and professional skills?

On average, 9.7 HQP were funded by each CHRP project, of which 2.1 were undergraduate students, 2.3 Master's students, 1.7 PhD students, 1.0 postdoctoral fellows and 2.2 research staff, according to the file review.

The low response rate to the HQP survey meant that the evaluation had to rely on the perspectives of funded and non-funded researchers, as well as anecdotal evidence from the case studies, to assess the program's impact on HQP.

The Learning Environment and Skills Gained

Funded researchers who responded to the survey reported that the training provided HQP with new knowledge, new skills, and practical experience (84%) and contributed to HQP completing their degree, thesis or publication(s) (80%). Unfunded researchers reported similar impacts on HQP, but HQP who participated in CHRP projects were perceived as significantly more likely to complete their degree, thesis or publication (80% compared to 64%, $p < 0.05$). The researchers' final reports further suggested that the most important benefits to participating HQP were that the experience "broadened their expertise" and provided them with "multidisciplinary experience." The cross-case analysis confirmed that the CHRP projects had contributed to creating a vibrant, interdisciplinary training environment. A student interviewed pointed out that, while the communication across disciplines had initially been challenging, the research project had helped "everyone to understand the same thing in different ways," resulting in new skills and understanding. A quote from a researcher interviewed for the case studies further illustrated this:

[The] research environment was unique because it allowed [a participating student] to work in a multi-sector domain... [and] working with specialists in engineering and medicine provided a very rich perspective that has direct application to health sciences as well as medicine.

Another researcher interviewed thought that, because students had trained in a multidisciplinary environment, they obtained transferable skills that would put them in a better position to work with researchers from other disciplines in the future, either in industry or academia. Moreover, the case studies highlighted that some health-related disciplines are strictly clinical, with limited emphasis on research (e.g., dentistry) and, therefore, HQP would typically not receive the type of exposure and training that the CHRP project provided.

A wide range of technical skills were also gained, according to HQP interviewed. The nature of the skills gained depended on the focus of the research project. One of the students explained:

I came to the lab with some culture experience but really I learned a ton more about how to evaluate what was happening when I was doing cell experiments. Everything about trying to evaluate how cells respond to a toxicity – all the photometry was new to me...all of my training in working with animals was new during that time period. All the animal techniques like how to set up and run a colony of animals – we were doing our own breeding in house – how to do injections, how to pull biological samples, and how to analyze those samples for the distribution of our particles after injection. I had never written a scientific paper before joining the group.

One of the former students interviewed explained that the CHRP project had been instrumental in influencing his career decisions. His experiences taught him how to apply engineering solutions to medical problems and the advantages of doing so in a multidisciplinary environment. Lacking experience and knowledge in clinical studies, he sought additional training in this area.

CHRP grants also seemed to have a long-lasting effect on the way researchers train students in some cases. A researcher interviewed had extended the multidisciplinary approach to training to all students within his lab. He explained that ensuring engineers have clinical exposure helps to broaden their minds and provides a human element to their research:

[HQP] get to talk to and work with patients, families, and it really makes the problem [they are] solving so much more real. They appreciate subtleties; they are not just solving an engineering problem; they are solving a human challenge. That's a subtle difference, but the students become more enthused with their research because there are real people that are going to benefit from this at the end of the day.

Employment Following the CHRP Project

When asked about the current employment status of HQP who had been involved in their CHRP project, researchers either responded that most were employed (78%) or in academic training (17%). HQP had been hired by a wide variety of organizations, according to researchers, including industry (18%), hospital/health organization (18%), academia (19%), government (15%), and the CHRP partners (8%). Slightly more than half of researchers (57%) thought students became more “job-ready” as a result of participating in the CHRP project.

Conclusions: About 10 HQP per project received interdisciplinary training opportunities as a result of the CHRP program. Without the program, half of the projects would not have proceeded and consequently not trained any HQP, and about a quarter that proceeded would have trained fewer than 10 HQP.

Researchers perceived HQP who participated in CHRP projects as significantly more likely to complete their degree, thesis or publication than HQP who participated in non-funded projects.

The most important benefit to HQP was that they had an opportunity to “broaden their expertise” and gain “multidisciplinary experience.” A large majority of HQP were either working or in academic training, according to researchers.

Question 7: To what extent are CHRP-funded projects supporting the transfer of knowledge to end-users/stakeholders?

Although the program started encouraging researchers to include partners in funded projects in 2002, and knowledge translation to end-users became a program objective in 2003, the involvement of partners was not a funding requirement before the 2012 competition, and the program was not designed to achieve the intermediate outcomes “research findings created that are relevant to industry and/or government” (INT.03) and “use of knowledge and technology within the research community, government and/or industry”(INT.04) until then. The intention of having the evaluation questions below look at the extent to which the program achieved these two outcomes before 2012 was to provide a baseline against which the next evaluation can assess the difference that the new partner requirements have made to the direction and use of the research produced.

In summary, the findings presented below looked at the extent to which partners had been involved in CHRP-funded research and whether knowledge, technology and expertise had been transferred to partner organizations, relevant users or stakeholders. The evaluation also aimed to explore whether research findings were relevant to and used by partners.

Question 7.1: To what extent are knowledge/technology users involved in CHRP-funded research?

Nature of Partner Involvement in CHRP Grants

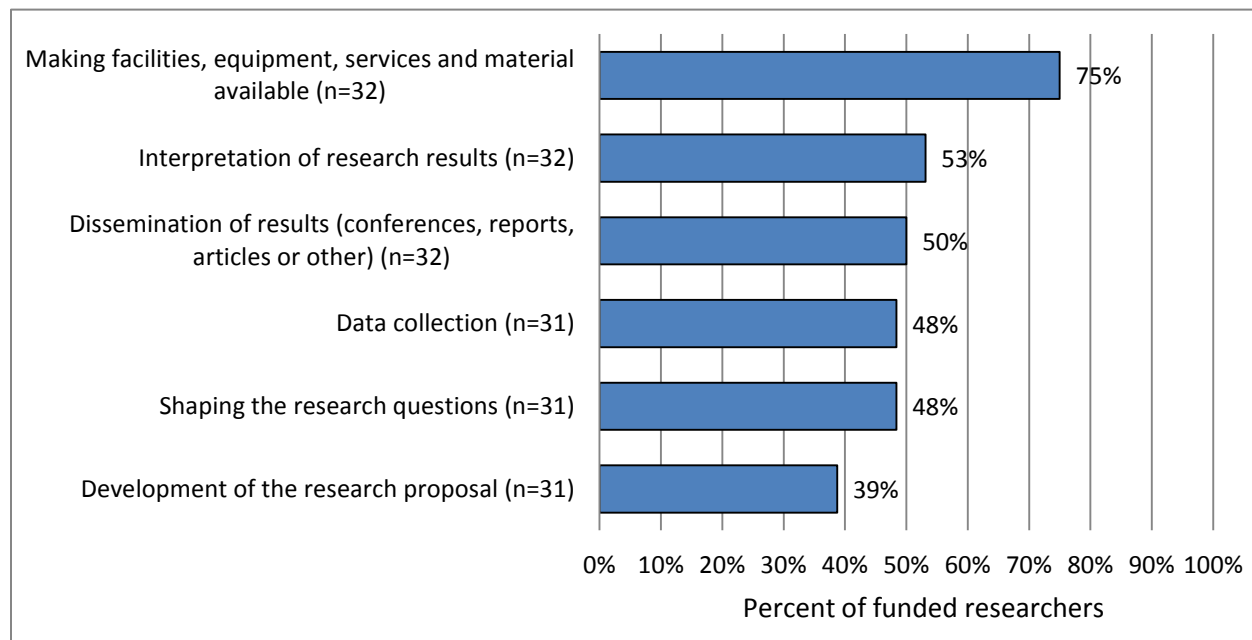
NSERC did not start to enter information on partners in NSERC’s administrative database until after 2004, when the management of the program was transferred from Research Grants and Scholarships division to Research Partnership Programs (RPP) division. That makes it difficult to determine to what extent researchers included partners on their applications before 2005. Between 2005 and 2008, there were 52 applications that involved partners (i.e., 17%),⁷ 18 of which were funded (representing 21% of all applications funded). Whether or not researchers involved partners at the application stage, results of the file review indicate that some partnerships were formed after the research project had commenced. Only 16% of the projects in the survey sample frame identified a partner at the application stage (i.e., 18 of 116 projects), but as many as 40% of the researchers responding to the survey indicated that their project involved partners.

⁷ It is possible that partner information was only partially entered into NSERC’s administrative database in 2005.

The majority of those partners who declined to participate in the survey claimed to have no knowledge of the project. This does, however, not mean that partners were not involved. It is important to remember that only partners who were listed in the funding applications were included in the survey sample. About a quarter of researchers (24%) indicated that they engaged partners after the projects had commenced. It is possible that some of these partners were more involved than those engaged at the application stage. That could partly explain why all researchers surveyed who had engaged partners indicated that their partners had been directly involved in the projects.

The survey asked the researchers who had engaged partners (24% of all researchers) how partners had been involved. According to researchers, partners were primarily involved by making facilities, equipment, services and material available (76%). About half of researchers reported that partners were somewhat engaged in the different phases of the research project, even though the researchers generally acted as the lead (Figure 5). This included interpretation of research results (53%), dissemination (50%), shaping the research questions (49%), and data collection (49%).

Figure 5: Nature of Partner Involvement According to Researchers



Source: Researcher survey (weighted n=79)

CHRP partners participated in regular discussions with the research team, according to half of the researchers (53%), or were available for consultation (47%). It was less common that partners co-supervised students' theses (22%), or provided training to the university team or received training from the university team (16%). A small proportion of funded researchers surveyed (16%) said that partners had provided cash contributions, and 44% indicated that they had provided in-kind support. Non-funded researchers reported significantly higher cash (50%) and in-kind (77%) contributions ($p < 0.01$ and $p < 0.05$). A possible reason for higher partner contributions to non-funded projects may be that projects required more support from partners

in order to proceed. Non-funded projects without a substantial partner contribution may not have proceeded to the same extent.

As noted in the methodology section of this report, partners had no or very limited involvement in the projects looked at as part of the case studies. The CHRP program has encouraged involvement of knowledge / technology users (e.g., partners from the private, public or voluntary sector organizations) from outside the academic sector since 2001, but barriers that were identified as part of the case studies were only related to involving partners from industry. One researcher explained that it was difficult to maintain the interest and involvement of companies that have the capacity to make substantial cash or in-kind contributions to the project since the project objectives are not aligned with their business priorities. A researcher associated with a different project pointed out that it was not until well after the end of the initial CHRP project when software prototypes were developed and the research was at the clinical trials stage that industry began to express interest. Similarly, in another case, it had taken seven years of research supported by two CHRP grants and one grant from the US National Institutes of Health to get the research to a stage where he could actively begin to seek industry partners. One of the researchers explained, "It makes more sense to involve partners now because we have solid data; we have patents; and we feel very comfortable to get industry partners involved."

Researchers' Reasons for Involving Partners

All but one of the funded projects had been initiated solely by university researchers, according to researchers. The primary reasons that researchers involved partners in their research projects were the skills and expertise that the partner brought to the project (66%), the partner's willingness to collaborate (61%), and increased knowledge transfer and use (52%). Other reasons for involving partners included enhancement of the learning experience of trainees (45%) as well as increased access to equipment (39%), facilities (29%) and data (26%). For about a third of researchers, the partner's previous experience with collaborative work (29%) and the partner's desire to use the research results (32%) were important considerations as well. It was quite rare that researchers involved partners for financial reasons (16%). Non-funded researchers were significantly more likely than funded researchers to involve partners for financial reasons (56% compared to 19%, $p < 0.01$), and the partner's desire to use the research results also played a more important role in researchers' decision to engage partners (62% compared to 32%, $p < 0.05$). This was not surprising, considering that non-funded projects were in greater need of funds.

Overall, most researchers (73%) who involved a partner were satisfied with the experience, stating that the partnerships had high relevance to their research project (83%). According to about half of researchers (51%), the projects led to increased networking and built collaborative relationships with knowledge/technology users.

Perceptions of Current Partner Requirements

Researchers who applied to the CHRP program before involvement of partners from the private, public or voluntary sectors became a formal requirement felt that the need to find a partner would have made it difficult for them to participate. About half of surveyed researchers (54%) considered the need to find a partner would have inhibited their ability to apply for a CHRP grant. The interview findings provided some insight into why it had been difficult for researchers to connect with Canadian industry partners, in particular. The early-stage nature of the research seems to have generated limited interest among potential partners. A researcher interviewed as part of the case studies highlighted that “until researchers have something to show them (i.e., promising results), industry is unlikely to be interested or involved.”

Several researchers interviewed expressed concerns regarding the inclusion of industry partners, as well as the stipulation that those partners be Canadian. One researcher explained by stating,

I’m worried about what I see as an increasing necessity of identifying a specific knowledge translation partner at the conceptual/early stage of research. The companies we’ve approached showed no interest unless a product was imminent. This does not mean the work is unimportant, but reflects the short-time horizon many Canadian companies seem to be restricted to.

Another researcher stated that had partner involvement been a requirement at the time of his team’s CHRP application, it would have “killed the whole project idea.” He explained that his team would never have been funded, as they would have had difficulty attracting the interests of industry partners in those early stages of research. Researchers further advised that limiting the knowledge/technology users to Canadian companies is problematic since many of the potential users of the new knowledge/technology are outside Canada. Some specialized industries are simply not big enough in Canada to support uptake and application. While some Canadian companies may exist, they tend to be very small and without research capacity. Specific fields are often dominated by a very small number of large players that are based abroad. Consequently, researchers are forced to look internationally for partners even if they would prefer to find a partner in Canada. Interviewees did not highlight barriers related to involving partners from the public or voluntary sectors.

Conclusions: Researchers who involved partners primarily chose to work with partners because of their expertise, and most researchers thought that the partnership was highly relevant to the project. Partners were involved in making facilities, equipment, services and material available. Partners were generally at least somewhat engaged in the different phases of the research project as well. About half of the researchers surveyed felt that having to find a partner would inhibit their ability to apply for a CHRP grant. Barriers to involving industry partners, in particular, included the early-stage nature of the research and an absence of Canadian companies that could use the results. Interviewees did not highlight barriers related

to involving partners from the public or voluntary sectors.

Question 7.2: To what extent have knowledge, technology and expertise been transferred to partner organizations (Canadian-based companies and/or government organizations)?

Although many years have passed since the completion of their projects, researchers who responded to the survey indicated that just over two-thirds (69%) had implemented their knowledge transfer plan and met their knowledge transfer objectives. Similarly, only slightly more than half (54%) of researchers reported that the project had significantly increased the knowledge base, leading to transfer of knowledge to knowledge/technology users. (Factors that limited the transfer of results are discussed under evaluation question 7.3.)

While the partner survey explored *how* knowledge, technology and expertise had been transferred to partner organizations, the results from this survey could not inform the evaluation owing to the low response rate and the small number of cases.

Knowledge transfer activities primarily targeting the *academic* community were captured in the final project reports. As stated under evaluation question 5 in this report, the majority of research projects (72%) resulted in at least one peer-reviewed article (Table 5). The projects had produced 5.0 peer-reviewed articles on average. In addition, almost half of the CHRP projects (48%) led to conference proceedings, more than two in 10 (21%) to journal or conference abstracts, and more than two in 10 (23%) to other knowledge translation activities.

Table 5: Knowledge Transfer Products Produced by CHRP Projects

Type of knowledge transfer product	Percent of projects that produced at least one	Average number of products produced per project
Peer-reviewed article	72%	5.0
Conference proceedings	48%	4.2
Journal or conference abstracts	21%	3.2
Other knowledge translation activities	23%	0.45

Source: Final project reports (n = 145)

Almost one-third of surveyed researchers (30%) reported that their CHRP project produced intellectual property that was protected, which highlights the early-stage nature of their research. In about half of the cases (54%) in which intellectual property was not protected, the nature of the research was not amenable to protection.

According to the survey, the most common strategy for protecting intellectual property was filing of patent applications (25%). This finding was consistent with what researchers reported when they completed their final project report. Funded researchers had filed an average of 0.75 patent applications at the time of the survey, and 0.41 patents had been issued. There were no

statistically significant differences between funded and non-funded researchers surveyed in terms of patent applications filed or issued. The second most common strategy for protecting intellectual property was non-disclosure agreements (9%) (Table 6).

More than one in 10 researchers (14%) reported that their projects licensed (or were in the process of licensing) proprietary results. CHRP projects had issued 0.13 licenses on average. Out of projects that had not issued licences or were in the process of doing so, almost a quarter (23%) did not produce results amenable to licensing.

Table 6: Intellectual Property Protection and Commercialization Outcomes for CHRP Projects

Type	Percent of researchers	Average number produced*
Patent applications filled	25%	0.75
Patents issued	23%	0.41
Non-disclosure agreements	9%	N/A
Licences issued	14%	0.13
Spin-off company	6%	N/A

Note: Some respondents did not know how many had been filed or issued.

Source: Researcher survey (weighted n=79)

The case studies provided a couple of examples in which licensing for health applications had taken place. One project that developed new imaging methods for detecting risk factors of acute heart attack and cerebral stroke resulted in licensing to a medical imaging company three years after project completion, even though the transfer to commercial application was expected to take much longer. Another project had also produced a licence, but it had later been returned by the company because of new corporate research priorities.

About one in 20 researchers completing the survey (6%) reported that their CHRP project led to a spin-off company (i.e., reported by five out of 79 researchers).

Conclusions: CHRP researchers had generally implemented their knowledge transfer plan, and one-half had transferred knowledge to knowledge/technology users. Most projects produced at least one peer-reviewed article. Funded researchers had not produced more patents or licences than non-funded researchers.

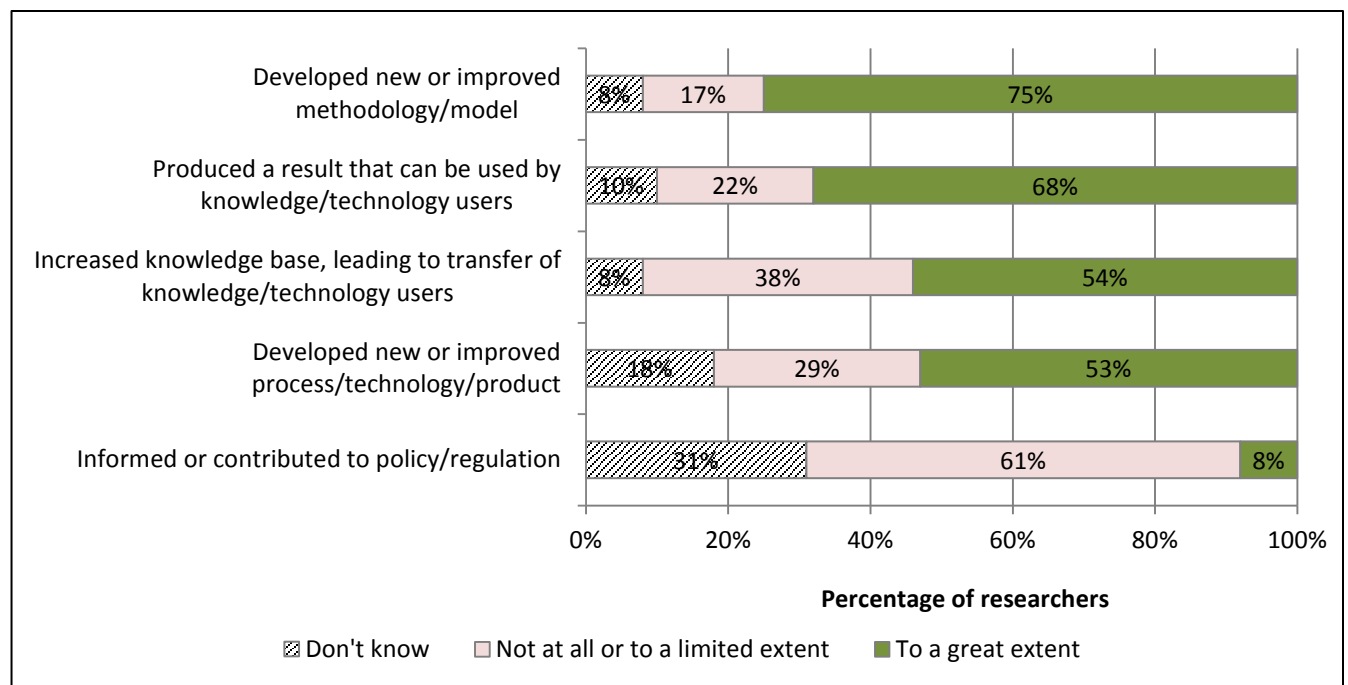
Question 7.3: How relevant are the research findings to industry and/or government? How have knowledge / technology users used and benefited from CHRP-funded research results?

Question 7.4: What factors have limited or facilitated the transfer of results?

Only slightly more than a third (37%) of surveyed researchers stated that transfer of knowledge to *partners* was an objective of their project. Nevertheless, funded researchers' survey responses provided a relatively positive picture of the relevance of the research results to *knowledge users* more broadly. In fact, more than two-thirds (68%) of researchers perceived that the results that were produced were at a stage at which knowledge/technology users could use them. Research projects that engaged partners were significantly more likely to have produced results that could be used ($p < 0.05$).

Researchers reported that their CHRP grant had, in most cases, led to the development of a new or improved methodology/model (75%), or a new or improved process, technology or product (53%), but it was rare that the projects informed or contributed to a policy or regulation (8%) (Figure 6).

Figure 6: Researchers' Perceptions of Impact on Partners



Source: Researcher Survey (weighted n = 79)

Due to the early-stage nature of the research and limited partner involvement, the case studies did not provide examples of how partners or end-users had used and benefited from CHRP-funded research. One case did, however, highlight that more partner involvement from the outset could have brought a stronger commercial focus to the project. One of the researchers interviewed said that, too late, they realized that there was a wider spectrum of applications of

the technology outside of the intended domain. At the time of the CHRP application, the researchers alluded to that possibility, but had no clear sense of what those other applications might be. The researcher pointed out that had a company been involved over the term of the project, the partner may have helped them to maintain a commercial focus and, as commercial timelines are much shorter, would have pressed the research team to develop the pre-production prototype much earlier. He also added, however, that this would have required twice or triple the amount of CHRP funding in order to accelerate and perhaps magnify the development in order to consider multiple applications. After more than six years after the research was conducted, one of the researchers decided to take on the commercialization aspects himself and has created a spin-off company. Overall, about one in 20 researchers (6%) reported that their CHRP project led to a spin-off company (i.e., reported by five out of 75 researchers).

Conclusions: Although researchers perceived the research results as being at a stage where partners could use them, the available evidence suggests that the results had limited relevance to at least some industry and government partners. The evidence is, however, not conclusive since partners who came onboard after the projects commenced could not be surveyed as part of the evaluation. The relatively early-stage nature of the research and limited partner involvement appeared to be the main factors that limited knowledge transfer and partner use of research results.

5 KEY FINDINGS – ECONOMY AND EFFICIENCY

Question 8 and 8.1: To what extent is the CHRP program being delivered in an effective and efficient manner? Can the efficiency of the CHRP program be improved (i.e., can program outputs be achieved in a more affordable manner)?

A program is efficient when it produces outputs at a relatively low cost. This means that the CHRP program is efficient if the cost of awarding and administering the awards is low and the activities are carried out in an effective manner.

Program Costs and Operating Ratio

A common measure of the efficiency of grant programs is to assess the ratio of operating expenditures to the total amount of grant funds awarded. This ratio represents the cost of administering a dollar of grant funds awarded. The granting agencies also commonly report operating expenditures as a percentage of total program expenditures. An estimate of administrative costs for the CHRP program was readily available for only five of the nine years under review from both councils (fiscal years 2004–05 to 2008–09) (Table 7:).

For fiscal years 2004–05 to 2008–09, NSERC and CIHR spent 5.3 cents to administer each dollar of CHRP grant funds awarded.⁸ The average operating ratio was almost the same for both NSERC and CIHR (i.e., a difference of 0.2 cents). This ratio was slightly lower than the ratio for the Research Partnership Programs (RPP) division (5.5 cents) and slightly higher than the ratio for NSERC as a whole (4.3 cents) for the same time period. The operating ratio for the CHRP program was higher from 2004–05 to 2006–07 due to relatively low amounts of grant funds awarded. Although it was outside the scope of the evaluation, as the figures were available, administrative costs for fiscal years 2009–10 and 2010–11 were also examined to ensure that the analysis was as current as possible. It should be noted that the operating ratio rose slightly in fiscal year 2010–11 (from 5.1 cents to 5.3 cents), which is still in line with the five-year average (5.3%).

NSERC and CIHR use different approaches to calculating the administrative cost associated with grant programs. NSERC calculates the direct and indirect costs of administering the program separately. At NSERC, direct costs comprise salary⁹ and non-salary costs, which are related primarily to the adjudication of the award. Non-salary costs also include a share of the costs relating to corporate representation and general administration for the RPP Division. Other direct costs associated with administering the programs, such as post-award management (which is a centralized function carried out by the Finance Division), and indirect costs, such as common administrative services for NSERC (e.g., finance, human resources and

⁸ NSERC's average operating ratio for the CHRP program was 4.7% in fiscal year 2002–03 to 2003–04.

⁹ Salary estimates exclude employee benefits (EBP).

information technology) cannot be provided at the program level. These other direct and indirect costs have also been included in the total calculation of costs and were estimated using the ratio of total CHRP awards to total grant funds. CIHR, on the other hand, estimates its administrative costs using a percentage of CHRP grant expenditures incurred by the council as a whole. These costs are presented as indirect costs in Table 7.

Table 7: Estimated Costs for the CHRP Program

	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
<i>Total administrative costs</i>	\$284,217	\$359,115	\$370,668	\$343,337	\$468,632	\$612,576	\$740,810
Total direct costs	\$129,946	\$153,351	\$120,562	\$101,075	\$146,850	\$204,525	\$214,872
Direct salary	\$55,673	\$88,779	\$68,434	\$47,635	\$78,232	\$122,308	\$123,330
Direct non-salary	\$74,273	\$64,573	\$52,128	\$53,440	\$68,618	\$82,217	\$91,542
Total indirect costs	\$154,271	\$205,763	\$250,106	\$242,262	\$321,782	\$408,051	\$525,938
<i>Total grant funds awarded</i>	\$6,387,697	\$6,528,901	\$6,251,224	\$6,417,952	\$9,156,050	\$12,071,491	\$14,110,182
Operating ratio (¢:\$1) (expenditures to grant funds awarded)	4.4¢	5.5¢	5.9¢	5.3¢	5.1¢	5.1¢	5.3¢
Operating expenditure as a percentage of total program expenditures	4.26%	5.21%	5.60%	5.08%	4.87%	4.83%	4.99%

Note: For NSERC, total direct costs include non-salary and salary spending. Salary spending (indirect cost) was estimated using the program's grant funds as a percentage of the directorate's (Council's) grant funds, multiplied by the directorate's total salary expenditures (all non-program directorates' total expenditures). Salary estimates exclude employee benefits (EBP). For CIHR, all administrative costs are included as indirect costs as these were estimated using the ratio of total CHRP awards to total grant funds.

Source: NSERC and CIHR administrative data

Program Delivery

Surveyed researchers and researchers interviewed as part of the case studies were asked to reflect on how the CHRP program, including its administration, could be improved. Other than concerns related to the review and monitoring process, which were discussed earlier in this report, researchers' recommendations focused on program guidelines and requirements as a means of enhancing access to funding rather than on the way the program is currently being delivered. Most frequently mentioned comments pertained to relaxing the program's funding requirements. Program guidelines that stipulate the need for an integrated knowledge translation plan at the application stage, for instance, was most often cited as a concern. Under the new program guidelines, all funded projects

must adopt an integrated knowledge translation (IKT) approach, i.e., projects where knowledge/technology users that could benefit from the research are meaningfully engaged at appropriate stages throughout the research process.

Researchers' IKT plan must be specified at the application stage. Although researchers who were surveyed did not see this as a barrier to obtaining CHRP funding, researchers who were interviewed identified it as a challenge when conducting early-stage research. The newly

implemented partner requirements were also considered as a barrier in this context (as discussed under evaluation question 7.1).

Another main concern associated with program delivery was the program's non-renewable policy; researchers surveyed indicated that the rules associated with this clause were overly rigid. With regards to CHRP's stipulation that funding is for a maximum of three years and cannot be renewed, one researcher completing the survey suggested,

While we do not expect CHRP to be providing long-term funding for any particular teams, it may be useful to consider renewing or extending the funding to a few teams that have demonstrated success and momentum.

Researchers who were interviewed supported this view; they explained that research is multi-stage, and much research is needed beyond those initial three years. In order to receive funding for subsequent stages of the same research, researchers must reapply to CHRP or seek alternative funding sources. As mentioned in section one, one in five (20%) funded researchers who received funding over the period 1999 to 2008 reapplied at least once.

Conclusions: The CHRP program appears to have been delivered in an effective and efficient manner. With an operating ratio of 5.3 cents for each dollar of grant funds awarded, NSERC's and CIHR's administrative costs for delivering the CHRP program have been similar to the costs for NSERC's RPP division as a whole (5.5 cents).

Overall, researchers did not have difficulties with the way that the CHRP program is being delivered. However, as a means of enhancing their access to funding, researchers recommended that program requirements related to the IKT plan and inclusion of partners be relaxed and that grants should be renewable.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Overall, the evaluation found that the CHRP program has been relevant, effective and efficient during the time period covered by this review.

Relevance

The CHRP program aligns with NSERC, CIHR, and government strategic objectives and priorities in the areas of science and technology, meets a unique need and does not duplicate other national research funding opportunities. In fact, findings from the case studies suggested that there may be a perceived need for a stronger continuum of funding support for collaborative research involving both NSE and health researchers in the research community.

Effectiveness

The CHRP program has contributed to establishing new relationships between researchers and maintaining relationships between health and NSE researchers following the completion of their projects. These relationships were often sustained through subsequent research collaborations. Researchers were satisfied with the quality of the collaboration with other co-applicants as well as the frequency of communication and processes for decision-making.

The CHRP program has made a considerable contribution towards addressing health-related issues through multidisciplinary research. The funded research generally achieved its intended, early-stage objectives and often transferred results knowledge/technology users according to researchers. The multidisciplinary approach had ultimately been highly beneficial for addressing the research challenges at hand.

About 10 HQP per project received training opportunities as a result of the CHRP program. Researchers perceived HQP who participated in CHRP projects as significantly more likely to complete their degree, thesis or publication than HQP who participated in non-funded projects. The most important benefit to HQP was that they had an opportunity to broaden their expertise and gain multidisciplinary experience. A large majority of HQP were either working or in academic training, according to researchers.

While the program had achieved its outcomes, the evaluation found that CHRP projects were no more likely than projects that proceeded in the absence of CHRP funding to have impacts on researchers involved.¹⁰ This means that the availability of funding is more important than the source of funding, with the funding source having little to no impact on whether projects

¹⁰ This means that the risk of over-estimating the impact of the CHRP program because of use of a non-equivalent comparison group was less of a concern than initially anticipated. (See the strengths and limitation section for a more exhaustive discussion on this issue.)

achieve outcomes. Funding opportunities provided by other organizations were, however, limited. Only 11% of non-funded projects could proceed (either in full or in part) without any support from NSERC or CIHR. Consequently, the CHRP program's key contribution is that it enables researchers to produce research that would otherwise not have been produced. In fact, half (50%) of non-funded projects did not proceed at all and many of those that did proceed would have reduced the scope of the project, often with less involvement of partners (44%) and HQP (46%).

Before the 2012 competition, the CHRP program was modified: the focus on potential impact and knowledge translation was increased through the requirement of having a partner (i.e., non-academic knowledge/technology user) involved in research projects. The CHRP program was not designed to fund projects with significant involvement of partners before that. As such, the program's past performance should not be judged based on the extent to which funded projects have produced results that are relevant to and used by knowledge/technology users from the private, public and non-profit sectors. Data the evaluation could collect from researchers on partner impacts should instead be used as baseline for future monitoring and evaluation. Researchers who involved partners primarily chose to work with partners because of their expertise, and most researchers thought that the partnership was highly relevant to the project. According to researchers who had engaged partners, partners were involved in making facilities, equipment, services and material available. CHRP partners were generally engaged in the different phases of the research project. The findings on partner involvement in CHRP projects could not, however, be validated with partners since only partners who were listed in the funding applications were included in the survey sample, and 24% of researchers indicated that they engaged partners after the projects had commenced. Although many researchers (68%) perceived the research results as being at a stage where partners could use them, the evaluation could not draw conclusions on the relevance and use of research results by partners since partners who came on board after the projects commenced could not be surveyed as part of the evaluation.

Many researchers who applied to the CHRP program before partner involvement became a formal requirement felt that having to find a partner would inhibit their ability to apply for a CHRP grant. Barriers to involving industry partners, in particular, were highlighted in interviews with researchers and included the early-stage nature of the research and an absence of Canadian companies that could use the results.

Economy, Efficiency, Design and Delivery

The CHRP program has been delivered in an efficient manner in that the administrative costs to deliver the program (an operating ratio of 5.3 cents for each dollar of grant funds awarded) are comparable to those of the NSERC Research Partnership Programs Directorate as a whole (5.5 cents).

Overall, researchers did not experience difficulties with the way that the CHRP program had been delivered. The two-stage application process was generally supported by researchers. The fairness and transparency of the application review process were subject to some criticisms,

particularly from unfunded applicants, even though researchers generally admitted to knowing little about the structure of the current review panel. The most common concern of both funded and unfunded researchers was the amount and quality of the feedback on the LOI stage. Researchers also recommended that program requirements related to the information knowledge transfer plan and inclusion of partners be relaxed and that grants be renewable.

Although there was sufficient performance information available to support the evaluation, further improvements could help ensure that contact information for all partners or HQP is available, that information on whether researchers primarily identify with NSERC or with CIHR is available and that applicant data can be shared between NSERC and CIHR in an efficient and timely manner.

6.2 Recommendations

A few recommendations are presented below.

Recommendation #1: Consider continued funding to collaborative health research involving health and NSE researchers through the CHRP program, and further clarify and communicate the position of the program in the continuum of funding opportunities provided by NSERC and CIHR

During the period under review, the CHRP program funded relatively early-stage research with a focus on generating collaborative, interdisciplinary research and training opportunities. Since the 2012 competition, a greater emphasis has been placed on producing tangible research results that can directly benefit Canada. While it was too early for this evaluation to look at the impacts of the changes to the program, the evidence presented in this report still supports the overall notion that there is a need for a program that funds collaborative health research involving health and NSE researchers. The evaluation therefore recommends that the CHRP program should be continued, provided that funding interdisciplinary, collaborative research projects involving NSE researchers, health researchers and partners continues to be a priority for NSERC and CIHR. Considering the recent program changes, it is important that CIHR and NSERC assess, clarify and communicate the program's niche in relation to the agencies' other funding opportunities. The role of partners from the private, public and voluntary sectors should also be explicitly articulated in relation to the niche of the program. The case studies highlighted that the research community could benefit from increased clarity on the issue of program niche.

Recommendation #2: Make improvements to program design and ongoing performance measurement

a. Assess whether it is feasible to provide more substantial feedback on Letters of Intent (LOIs) to applicants

Researchers asked for more substantial feedback on their LOIs to help enhance the quality of their next submission (i.e., narrative reports from the peer reviewers as opposed to quantitative reports indicating only whether the LOI fulfilled certain criteria). Providing

more qualitative feedback would, however, increase the burden on the peer-review committees, as the program receives a substantial number of LOIs.

b. Review the program's performance measurement strategy (including the logic model) to ensure that it effectively monitors the extent to which the CHRP program supports its new objectives, the impacts of the new partner requirements on the research community and program impacts on HQP

Since the 2012 competition, the CHRP program is placing a greater emphasis on partner involvement, knowledge transfer and use of research results. The program's performance measurement strategy and final project report templates should therefore be revisited to ensure that they can capture the two new outcomes in the program's logic model. When relevant, the indicators and data-collection instruments should be consistent with those used for measuring the impact of other NSERC and CIHR programs to help facilitate further comparisons between programs.

The effect of the changes to the partner requirements on the research community and on research also need to be closely monitored to ensure that the changes have had the intended effect.

Both intermediate and long-term partner impacts could be captured through a partner follow-up survey administered a couple of years after the completion of the grant. To ensure that a survey sample of partners can be identified for future performance monitoring and evaluation, it is important that program staff collects information from researchers on which partners have *actually* been involved as part of the final project report and record this information in electronic format before the project file is closed. Electronic data-capturing of applications and final reports has the potential to improve the efficiency of future evaluations and monitoring activities as it would eliminate the need for manual data-entry. Similarly, contact information for HQP should be collected and recorded to ensure that HQP can be surveyed as part of the next evaluation.

c. Record information on whether researchers can be identified primarily as NSE or health researchers

It will be useful for the next evaluation to have explicit information on whether individual researchers can be identified primarily as NSE or health researchers. How the information will be collected and what criteria should be used will need to be determined. (If a self-identification approach is used, information can be collected from researchers in the application or the final reporting stage.)

d. Establish a protocol for sharing applicant, partner and HQP data between NSERC and CIHR

A protocol for the sharing of applicant data between CIHR and NSERC would help ensure that sufficient data is available to support the next evaluation of the program. For this

evaluation, two ethics review boards required several months to determine what information CIHR would be able to share concerning applicants' funding history.

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