EVALUATION OF NSERC's UNDERGRADUATE STUDENT RESEARCH AWARDS

FINAL EVALUATION REPORT

November 29, 2012

EXECUTIVE SUMMARY

NSERC's Undergraduate Student Research Awards (USRA) were established in 1980 to provide funding to undergraduate students wishing to complete a sixteen-week work term in a university or in an industrial environment. The evaluation covered the time period from fiscal year 1999-2000 to fiscal year 2009-10. The purpose of the evaluation was to provide NSERC senior management with an assessment of the program's relevance and performance. The evaluation questions were developed in consultation with Scholarship and Fellowship senior management, and address the core evaluation issues laid out in the *Directive on the Evaluation Function* (2009).

Multiple lines of evidence were employed to answer all evaluation questions, including a document/literature review; an administrative data review; interviews with university representatives; interviews with NSERC staff; and web-based surveys of past USRA holders, university supervisors, industry supervisors and representatives from organizations that had participated in NSERC's Industrial R&D Fellowships, Collaborative Research and Development grants or Industrial Research Chairs. While the design benefitted from multiple lines of inquiry and relatively high survey response rates, it had two limitations: absence of a student comparison group and absence of baseline data. The evaluation therefore turned to other studies of undergraduate research award programs to establish criteria for program success. Given that the USRA program is a low-risk program, these mitigating strategies were deemed sufficient for ensuring that the assessment of its performance could be substantiated.

Relevance

The evaluation found that there is a continued need for a growing supply of highly qualified personnel (HQP) in Canada and that it is important for industry to have access to graduates with a Master's degree. There is also a strong perceived need for the USRA program among participating universities, university researchers and companies, both because it encourages students in the natural sciences and engineering (NSE) to undertake graduate studies and pursue a research career in the NSE and because it adds significant value to the students' undergraduate education. The USRA program complements rather than duplicates other undergraduate programs in Canada, as other programs have a more narrow focus and are smaller in scale. The evaluation also found that the USRA program is consistent with the federal government's S&T strategy, NSERC's strategic outcomes and NSERC's Strategy for Partnership and Innovation (SPI).

Design

The evaluation explored what an appropriate award level would be for attracting and supporting students. The findings suggest that the level of pay required to attract students to a USRA varies based on factors such as discipline, year of study, type of work, skill requirements and other individual circumstances. The importance of ensuring that the value of the award is at least equivalent to minimum wage was underlined by the fact that the award represents on average almost two thirds of students' personal annual income.

The criteria and processes used by universities to select awardees were also looked at as part of the evaluation. One of the commonalities across all of the universities interviewed was a high demand from highly qualified students for a relatively small number of awards. For this reason, despite there being variations in universities' selection processes and eligibility criteria, students who received an award had high GPAs. Universities with a centralized selection process identify the top students to receive USRAs largely on the basis of GPA alone. Universities using a decentralized selection process, on the other hand, employ broader criteria for determining who the top candidates are.

Effectiveness

In assessing the program's effectiveness, the evaluation looked at awardees' acquisition of R&D work experience and skills, their knowledge about what a research career entails, and their interest and motivation in pursuing graduate studies and a research career, as well as the extent to which they pursue graduate studies and a research career in the NSE.

While awardees perceived the work term to have provided them with a wide range of skills useful to their subsequent career and education, the most significant contribution of the experience may have been exposure to the research environment. Multiple awards, particularly with different supervisors or organizations, added value to the students' research experience.

Survey findings show that awardees' exposure to research makes them more knowledgeable about what a research career entails. Only a portion of award holders do, however, experience an increased interest in R&D (39%) or decide to change their educational plans as a result of the award (28%). The most likely reason for this is that the awards are given to students with high academic achievements and an already existing interest in research in the NSE. It is just as common for the USRA to help maintain awardees' interest in R&D as to increase their interest in R&D. Similarly, the USRA only makes some awardees more interested in a career in academia or industry (46% and 34% respectively).

Award holders (85%) are more likely than other students (28%) to undertake graduate studies, but not necessarily due to their participation in the USRA program, as students of a high academic calibre and a strong interest in research are more likely to receive a USRA in the first place. After completing their university education, at least half of awardees pursue a research career in the NSE.

While it is not an intended outcome of the program, the evaluation also found that the USRA program contributes to researchers' productivity and gives them an opportunity to recruit and assess students for graduate studies. The USRA program helps industry improve research productivity and recruit new employees.

Efficiency and Economy

NSERC's administrative costs for delivering the USRA program are low (less than 5%) and the administration of the program appears to be efficient. Industry host organizations' compliance costs represent only 17% of the reimbursement they receive from NSERC. Stakeholders were

generally satisfied with the operation of the program, although some areas for improvement were identified.

The evaluation looked at the extent to which it would be possible for universities to provide top-ups beyond the current minimum amount. University supervisors indicated that they could pay a higher top-up than the minimum amount, but no more than the amount they are currently topping up USRA awards. If they had to pay more, they would have to hire fewer students. An increase in their top-up amount would affect their overall research budget, as almost all researchers pay USRA holders out of their own grants. Industry supervisors prefer that NSERC keep the value of the award and the number of awards the same rather than increasing the number of awards (by reducing the award amount) or increasing the value of the award (by decreasing the number of awards). It would take a substantial increase in the reimbursement amount before a considerable portion of industry organizations would consider hiring more undergraduate students.

Overall Conclusions and Recommendations

Undergraduate Student Research Awards have strong support from institutions, researchers, companies and students. Overall, the evaluation found that the USRA program is addressing an important need and continues to be relevant to Canada's priorities in R&D and S&T. The program contributes to the supply of HQP, primarily by contributing to their development, but also by increasing the supply, albeit to a more limited extent. Finally, the findings suggest that the administration of the program is working well overall, but further improvements could help ensure that the most effective and efficient means are being used to achieve program outcomes. The evaluation resulted in the following recommendations:

▪ **Recommendation #1:** Continue offering Undergraduate Student Research Awards and make adjustments to the program's objectives and expected outcomes

▪ **Recommendation #2:** Consider making improvements to the design and delivery of the program, including the following:

a) Ensure higher remuneration for students.

b) Adjust the timing of the award notification for university (URU) awards.

c) Provide additional guidance to liaison officers on how NSERC expects universities to operationalize the selection criteria "aptitude for research".

d) Adopt new strategies to promote the USRA program.

e) Carry out formal consultations with university liaison officers on the newly implemented online application system.

f) Create an online reporting system for industry host organizations, as well as more comprehensive and structured information on how to complete the required paperwork.

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1   INTRODUCTION

This report presents the key findings, conclusions and recommendations from the evaluation of NSERC's Undergraduate Student Research Awards (USRA). The evaluation covered the time period from fiscal years 1999-2000 to 2009-10. NSERC's Evaluation Division conducted the evaluation in collaboration with Prairie Research and Associates (PRA), which conducted the surveys of awardees, university supervisors and industry supervisors.

The purpose of the evaluation was to provide NSERC senior management with an assessment of the program's relevance and performance. 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 USRA Program

The Natural Sciences and Engineering Research Council of Canada (NSERC) offers a number of programs to foster a supply of highly qualified Canadians with leading-edge scientific and research skills for Canadian industry, government, and universities. The Undergraduate Student Research Awards (USRA) program was established in 1980 to provide funding to undergraduate students wishing to complete a sixteen-week work term in a university or in an industrial environment. The USRA is expected to stimulate students' interest in research in the natural sciences and engineering (NSE), and encourage them to undertake graduate studies and pursue a research career in these fields. A USRA may be held in a university setting (URU) or a non-university setting (URI), depending on whether the student wishes to gain research work experience in a university or industry lab.

In 2010, NSERC offered approximately 3,300 URU awards and 900 URI awards. URU quotas were stable from 2003 to 2007 (Figure 1). Additional URU awards were offered in 2008 due to availability of funds. The quotas were slightly reduced in 2009-10 due to reallocation of funds to other NSERC programs. About 1% of the awards have gone to Aboriginal students. The demand for URIs has been relatively stable over the years.

Figure 1: Number of Awards and Expenditures
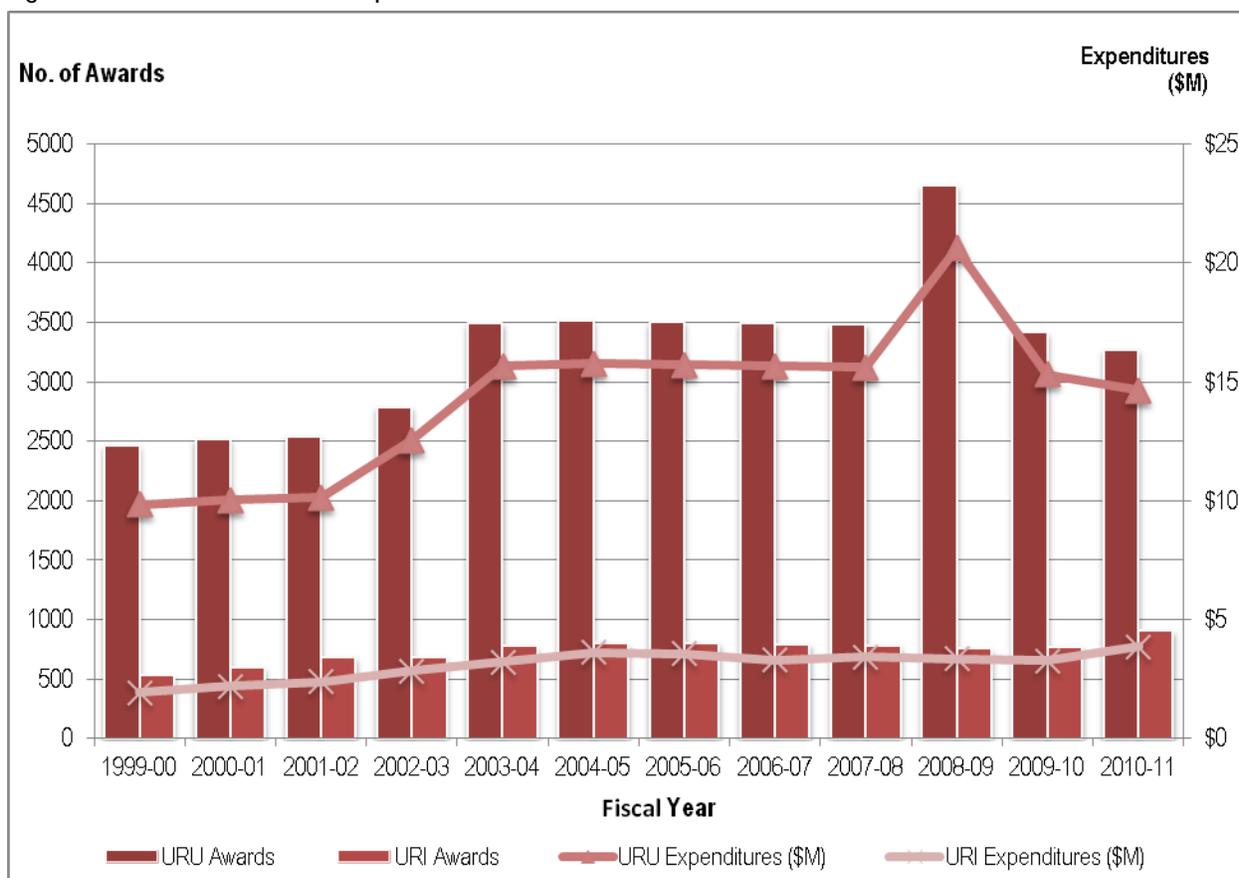
Canadian citizens (or permanent residents of Canada) who are registered in a bachelor's program at an eligible university and have obtained a cumulative average of at least B or B-over the previous years of study are eligible to apply. They must have completed the equivalent of first year university, and have been registered in the term immediately prior to holding the award.

Applications for USRAs in universities are not assessed by NSERC. The USRA application and nomination process is handled by the host institution. Universities establish their own selection criteria within the broad guidelines established by NSERC; namely, the student's academic record and aptitude for research. A USRA liaison officer is appointed by the university to administer the selection process. Once selected by the university, the applications are forwarded to NSERC, where they are checked for compliance with the program regulations before awards are approved. NSERC assigns each university a quota of USRA awards. USRA quotas are calculated using a formula that includes a rolling three-year average of Post Graduate Scholarships awarded to students who applied from the institution as a proportion of all awards available per year, a rolling three-year average of the number of NSERC grant holders at the institution as a proportion of all grant holders per year, and a factor to adjust for the budget available for the program. To encourage Aboriginal students to participate in the

program, awards given to Aboriginal students are not included in the university's quota. There is a minimum quota of four for small institutions.

For USRAs in industry, the company screens the applications and selects the student(s) it wishes to nominate. Applications are forwarded to NSERC for review and are awarded if the student and the host organization meet NSERC's eligibility criteria. NSERC may support up to 15 students per eligible organization per fiscal year.

The duration of the award is 16 consecutive weeks on a full-time basis if the award is held at a university. For URI, the duration of the award must be no less than 12 consecutive weeks and no more than 16 consecutive weeks. USRA awards have a value of $4,500 for a full 16-week period. Universities and industry are required to supplement the amount of the award by at least 25% of its value. A travel allowance may also be granted if students take up the award at a university other than where they are currently registered. A student can hold a total of three USRA awards during his or her undergraduate degree.

Universities must submit applications for the summer term (May-August) to NSERC by May 15th. NSERC sends the students' award letters to the USRA liaison officers by the end of July (Table 1). NSERC does not review applications until after students have commenced their work term. The reason for this is that many students who accept a USRA subsequently change their plans. Reviewing applications after the work term has begun means that program staff do not spend time reviewing applications from this group of students. Universities must be prepared to continue to employ any students whose applications are rejected by NSERC. Payments for the summer term are forwarded to universities in the first or second week of July. The award notifications and payments are generally sent out earlier for the fall and winter work terms.

Table 1: URU application timelines

	Summer (May-Aug)	Fall (Sept-Dec)	Winter (Jan-Apr)
Universities submit applications to NSERC	May 15	Oct 15	Jan 15
NSERC sends students' award letters to universities	July 31	Nov 15	Feb 15
NSERC forwards payments to universities	July 16	Nov 30	Feb 28

A logic model identifies the linkages between the activities of a 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. As such, the logic model serves as a "roadmap", connecting activities to the ultimate outcomes, thereby identifying the steps that will demonstrate progress towards expected results. Five levels of performance are delineated in the logic model presented below in Figure 2: activities and outputs, immediate outcomes, intermediate outcomes and ultimate outcomes.

Figure 2: USRA Logic Model

Undergraduate Student Research Awards (USRA) Logic Model

Activities

Publication of material and promotion of program *(A1)*
Provision of guidance material to universities *(A2)*
Application processing and review *(A3)*
Monitoring of the USRA program *(A4)*

Outputs

Program material *(O1)*
Guidance material *(O2)*
Monitoring reports *(O3)*
Undergraduate Student Research Awards *(O4)*

Immediate Outcomes

Awardees obtain R&D work experience and skills in an industrial or academic setting *(IMM1)*

Awardees become more interested in research in the NSE and/or more knowledgeable of what a research career entails *(IMM2)*

Awardees become more motivated to pursue a research career in the NSE *(IMM3)*

Awardees become more motivated to undertake graduate studies in the NSE *(IMM4)*

Intermediate outcomes

Awardees undertake graduate studies in the NSE *(INT1)*

Awardees pursue a research career in the NSE *(INT2)*

Ultimate Outcomes

A contribution to the supply of highly qualified Canadians with leading-edge scientific and research skills for Canadian industry, government and universities *(ULT1)*

Activities and Outputs

The program activities listed below are carried out by NSERC and are within the control of NSERC staff:

- *Publication of material and promotion of program (A1).* NSERC publishes a *Program Guide* for students and fellows that includes a program description and information on application procedures for USRA and other NSERC programs. A PowerPoint presentation about the program is available on NSERC's website. The USRA program is promoted to institutions through NSERC's regional meetings and by the regional offices. NSERC also includes information about the USRA program in letters that are sent to companies participating in research projects funded by NSERC (i.e., the Collaborative Research Development program). *Provision of guidance material to universities (A2). NS*ERC provides guide*lines that un*iversities must follow when implementing selection processes at their institutions to identify USRA candidates. Universities may develop their own selection criteria in addition to NSERC's minimum standard requirements.

- *Review and processing of applications (A3).* Universities are responsible for selecting the USRAs at their institution, but the applications are also reviewed and approved by NSERC to ensure compliance with program regulations. NSERC reviews, processes and awards industry USRA applications.

- *Monitoring of USRA program (A4). Monitoring of the program involves financial monit*oring and measurement of program outcomes through an annual exit survey of awardees upon completion of their work term. For URI, both the awardees and their host organizations are required to submit final reports to NSERC.

The activities described a*b*ove enable NSERC to produce the program outputs: *program material, guidance material, monitoring reports and USRA* awards.

Outcomes

The outcomes for the USRA program are expected to occur at different times. It is important to note that the achievement of program outcomes relies on the activities and decisions of awardees, university supervisors and industry supervisors, who are not under the direct control of NSERC.

Immediate Outcomes

The immediate outcomes are a direct result of the USRAs and occur during the awardees' work term at either a university or industry lab. During this term, *awardees obtain R&D work experience and skills in an industrial or academic setting (IMM1)*. As a result of their research experience, awardees are expected to *become more interested in research in the NSE, more knowledgeable about what a research career entails (IMM2)* and *more motivated to pursue a research career in the NSE*

(IMM3). Some awardees are also expected to become *more motivated to undertake graduate studies in the NSE (IMM4)* as a part of their academic training.

Intermediate Outcomes

The intermediate outcomes are expected to occur following completion of the awardees' undergraduate degree. Awardees who develop greater interest in research in the NSE and/or are more knowledgeable as to what a research career entails are expected to *pursue a research career in the NSE (INT2)*. University and industry supervisors who decide to hire their former awardees help realize the awardees' career choice. Awardees who maintain or develop increased motivation for graduate studies during their work term are expected to *undertake graduate studies in the NSE (INT1) as part of their career path*. The awardees' decision to undertake graduate studies may be facilitated by participating university supervisors who actively recruit awardees to graduate programs.

Ultimate Outcome

The ultimate outcome represents the long-term goal of the program. Awardees who successfully pursue a research career in Canada contribute to the *supply of highly qualified Canadians with leading-edge scientific and research skills for Canadian industry, government and universities (ULT1, PAA Expected Result 1.2).*

1.2 Evaluation Questions

The evaluation questions were developed in consultation with Scholarships and Fellowships senior management, and address the core evaluation issues laid out in the *Directive on the Evaluation Function* (Table 2). The evaluation questions pertaining to program effectiveness are explicitly linked to the expected outcomes in the logic model. The program's contribution to its ultimate outcome is inferred from the findings related to Evaluation Question 9. A detailed evaluation matrix (including indicators and sources of information) was also developed to help guide the evaluation.

Table 2: Evaluation questions

Relevance: To what extent does the USRA program address a demonstrable need and is aligned with government priorities and is appropriate to the federal government
1. Is there a continued need to encourage students in the NSE to undertake graduate studies and pursue a research career in the NSE?
2. Does the USRA program continue to be consistent with NSERC and government-wide priorities?
3. Is there a necessary role for the federal government in delivering the USRA program?
Design and Delivery: The extent to which the USRA program is being administered and delivered in the intended manner
4. What is the optimal value of the award for attracting and supporting students?
5. How have universities selected awardees?
Success/Impact: The extent to which the program is achieving or demonstrating progress toward intended outcomes
6. To what extent have awardees obtained R&D work experience and skills? (IMM1)
7. To what extent have awardees become more interested in research in the NSE and more knowledgeable about what a research career entails? (IMM2)
8. To what extent have awardees become more motivated to pursue a career and to undertake graduate studies in the NSE? (IMM3, IMM4)
9. To what extent do awardees undertake graduate studies and pursue a career in the NSE? (INT1, INT2)
10. How and to what extent do researchers and industry benefit from the USRA program?
Efficiency and Economy: The USRA program's resource utilization in relation to the production of outputs and progress toward expected outcomes
11. To what extent are the most effective and efficient means being used to achieve program outcomes?

1.3 Design and Methods

Multiple lines of inquiry were used to address each evaluation question, and all key program stakeholder groups were consulted as part of the evaluation. The assessment of the extent to which the USRA program has achieved its intended outcomes primarily relied on surveys of award holders (the exit survey and the follow-up survey). Other lines of inquiry were used to validate the findings from the awardee surveys. The data collection methods and data sources are described below.

Document/Literature Review

The document/literature review helped to answer evaluation questions related to the relevance, design and efficiency/economy of the USRA program. The literature also provided background and context for the interpretation of findings, and in a few cases, a basis for comparison (i.e., graduate studies enrolment rates from Statistics Canada).

Administrative Data Review

Administrative data on awardees from NSERC's Award Management Information System (NAMIS) were used to provide contextual information for the evaluation and help address a few evaluation questions.

Interviews with University Representatives

The interviews with university representatives provided eligible universities' perspectives on the program and helped to build an understanding of how the URUs are being administered at the institutions. The evaluation team conducted semi-structured phone interviews with representatives from 20 of the 71 universities that were eligible to nominate URU award holders (see *Annex B*). The sample was selected based on three criteria: the size of the institution;[1] the proportion of the total number of USRAs allocated to the institution; and the extent of the university representative's experience with the USRA program. Two thirds of interviewees (13) were selected from medium/large universities since the vast majority of the USRA awards are allocated to medium/large universities and one third (7) from small universities.

Awardee, Researcher, and Host Organization 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 intermediate- and long-term outcomes. The evaluation drew on results from surveys of the following groups:

- *Past USRA award holders*, including:

  o *An exit survey of award holders who had completed their work term between 1999 and 2010.* NSERC has administered a census of award holders on an ongoing basis since 1999. Award holders are asked to complete the survey at the end of their work term(s). The evaluation used the results from this survey (i.e., responses collected from 1999 to 2010) primarily to assess immediate outcomes.

  o *A follow-up survey of USRA holders who had completed their work term between 1999 and 2006.* This census was administered as part of the evaluation, primarily to obtain more detailed information on awardees' experiences, as well as up-to-date information on their career paths.

  o *A follow-up survey of USRA holders who completed their work term between 2009 and 2010.* This group was surveyed through a census to obtain up-to-date information on other opportunities available to students and current pay levels.

- *University supervisors who supervised URU holders between 1999 and 2009.* A random sample of researchers who supervised USRA students was surveyed to help assess program relevance and performance, as well as unintended outcomes.

- *Industry supervisors who supervised URI holders between 1999 and 2009*. One industry representative from each organization was surveyed to help assess program relevance and performance, as well as unintended outcomes.

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[1] The institution size is defined based on a three-year average of annual NSERC funding received: small < $3,495,469; medium <$13,981,876; large >$13,981,876.

■ *Industry organizations that have participated in NSERC's Industrial R&D Fellowships (IRDF), Collaborative Research and Development (CRD) grants, and Industrial Research Chairs (IRC).* A census of industry organizations that participated in NSERC's IRDFs (competition years 2000-08) and a random sample of organizations that participated in CRDs and IRCs. Some of these organizations had never participated in the USRA program. The surveys explored whether or not these organizations had an interest in the USRA program, the reasons some of them had not participated, and whether they had used other programs or mechanisms to hire undergraduate students.

The survey response rates were acceptable given the survey mode and the populations surveyed (Table 3). The response rate was higher for the exit survey than for the follow-up survey because the exit survey was administered closer to the time of the award, when NSERC had up-to-date contact information for students, and awardees would have been more inclined to respond to a survey regarding their award. Overall, the characteristics of the respondents were very similar to the characteristics of the populations. Awardees who had held an award in recent years and those who had held more than one award were somewhat over-represented among those who completed the follow-up survey. Researchers who had supervised more than one award holder were slightly over-represented as well. Pearson's chi-square and analysis of variance (ANOVA) were used to examine differences between groups where appropriate.

Table 3: Survey response rates

	USRA holders (exit survey 1999-2010)	USRA holders (follow-up surveys)	University Supervisors	Industry Supervisors	Representatives from IRDF, CRD and IRC Organizations
Population	32,383	29,917	3,314	749	1,967
Sample	32,383	29,917	2,968	749	1,663
Valid sample	n/a	18,014	2,645	357	1,123
Responses	21,162	6,471	1,336	145	322
Response rate	65.3%	35.9%	50.5%	40.6%	28.7%
Sample error	±0.2%	±1.0%	±1.6%	±6.6%	±4.6%

Note: The valid sample excludes attrition (e.g., respondents who could not be reached due to outdated contact information). For the exit survey, the valid sample was not known for the early years, so the response rate is calculated based on the population.

Interviews with NSERC Staff

Unstructured interviews with NSERC staff helped ensure that the evaluation team had an in-depth understanding of the program and its environment. The interviews also provided an opportunity to consult program staff on possible interpretations of the evaluation findings.

Strengths and Limitations

While the evaluation design benefitted from multiple lines of inquiry and relatively high survey response rates, it had two key limitations: the absence of a student comparison group and the absence of baseline data.

The evaluation design for assessing the achievement of program outcomes could have been stronger if the evaluation had used an equivalent comparison group of students who were not recipients of the USRA award. This would have helped determine whether students in receipt of a USRA award become more interested in research in the NSE and more knowledgeable as to what a research career entails than students who do not complete a research work term. Comparisons between these two groups with respect to students undertaking graduate studies and pursuing a research career in natural sciences and engineering could also have been conducted. NSERC could not, however, access a relevant student comparison group to be surveyed as part of the evaluation (i.e., cohorts of undergraduate students from 1999-2006).

Baseline data on awardees' level of interest in research in the NSE, their knowledge of what a research career entails and their plans to pursue a research career prior to their USRA work term could have further strengthened the evaluation design. This would have made it possible to compare awardees' level of interest, knowledge and career aspirations across two time points: just prior to receipt of the award and immediately following completion of the award. Baseline data would have been particularly valuable given that students who receive a USRA are of high academic calibre and generally have an already existing interest in R&D.

In the absence of a comparison group and baseline data, the evaluation turned to other studies of undergraduate research award programs to help establish criteria for program success. Findings from evaluations of similar programs were also looked at to determine what outcomes are generally produced by programs like the USRA. Custom data on the proportion of NSE undergraduates who continue on to graduate studies were also ordered from Statistics Canada. Given that the USRA is a low-risk program, these mitigating strategies were deemed sufficient for ensuring that the assessment of its performance could be substantiated. (This is further discussed in the Conclusions and Recommendations section of the report.)

2   KEY FINDINGS – RELEVANCE

Question 1:   Is there a continued need to encourage students in the NSE to undertake graduate studies and pursue a research career in the NSE?

As Canada moves from a resource-based economy to a knowledge-based economy, economic growth and competitiveness are becoming increasingly tied to scientific and technological development and innovation (Statistics Canada, 2011). There is a critical link between Canadian productivity, economic growth and innovation (The Council of the Canadian Academies, 2009; Stewart, 2009). In a knowledge-based economy, trained S&T researchers and technicians drive innovation by producing knowledge and applying research results. The long-term growth of Canada's innovation system is therefore dependent on constant growth in the number of workers possessing science and engineering skills (Organization for Economic Cooperation and Development (OECD), 2003). At the same time, Canada continues to lag behind other OECD countries in the proportion of graduates from science, math, computer science, and engineering programs, and the number of Master's and PhD degrees overall (Association of Universities and Colleges of Canada (AUCC), 2007). The Government of Canada (2007) recognized the need to stimulate the supply of HQP in its S&T strategy, "Mobilizing Science and Technology to Canada's Advantage". By doing so, Canada can contribute to innovation, advance S&T knowledge, and boost industry's productivity and growth.

While HQP with Master's and doctoral degrees are essential in university research, employees with Master's degrees and PhDs are also highly in demand in the private sector (AUCC, 2007). A majority of the organizations that had hosted a URU holder expressed a need for HQP with undergraduate degrees (90%) and Master's degrees (75%) in particular (Table 4). Less importance was attached to job candidates with a doctorate or postdoctoral degree. However, when host organizations were surveyed in conjunction with the evaluation of the Industrial Research and Development Fellowships (IRDF), they indicated that for research-intensive positions, they employed a higher ratio of staff with PhDs than with undergraduate or Master's degrees.

Table 4: Importance of a degree in NSE for hiring full-time employees

Importance placed on degree	Percent of industry supervisors			
	Undergraduate	Master's	Doctorate	Postdoctoral
Important (5–7)	89%	75%	55%	30%
Neither important nor unimportant (4)	3%	17%	21%	27%
Not important (1–3)	4%	5%	19%	35%
Don't know	3%	4%	6%	8%

Note: Total percentages may not equal 100% due to rounding.

Source: Industry Supervisor Survey, n=145

With respect to the USRA program, among USRA liaison officers and university and industry supervisors, there was also a strong perceived need for a program that encourages graduate studies and research careers in the NSE. A university supervisor responding to the survey stated:

> If a program like the USRA program did not exist, it would mean a further disconnect between research and education. A University should engage undergraduate students in research and the NSERC USRA is a very effective tool to do so. Not having this would mean in many cases I would probably just hire a research technician at 20% who can do the same work of the USRA at 100% and faster. But it would be sad for Canada to consider this step.

Liaison officers and awardees were also in favour of the program because it adds significant value to NSE students' undergraduate education. Support for the program is so strong that it has even prompted several universities to establish their own complementary undergraduate summer research programs in order to supplement their NSERC quota and reach greater numbers of undergraduate students.[2] In some cases, they have also expanded the practice to the social sciences and humanities.

Conclusions: There is a continued need for a growing supply of HQP in Canada, and it is important for industry to have access to graduates with a Master's degree. There is also a strong perceived need for the USRA program among participating universities, university researchers and companies, both because it encourages students in the NSE to undertake graduate studies and pursue a research career in the NSE, and because it adds significant value to the students' undergraduate education.

Question 2:   Does the USRA program continue to be consistent with NSERC and government-wide priorities?

The USRA program's focus on stimulating undergraduate students' interest in the NSE and encouraging them to undertake graduate studies and pursue a research career in these fields aligns well with one of the three S&T advantages (Government of Canada, 2007, p.18): **"**Canada must grow its base of knowledge workers by developing, attracting, and retaining the highly skilled people we need to thrive in the modern global economy". With respect to NSERC priorities, the program contributes to NSERC's strategic outcome 1.0 People: Highly skilled science and engineering professionals in Canada (NSERC, 2010, p. 4). The USRA program's expected outcomes also support NSERC's Strategy for Partnership and Innovation (SPI). Consistent with the URI objectives, the SPI aims to connect people and skills in order to benefit industry through innovation and advancing new technologies (NSERC, 2009).

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[2] These programs are discussed further in the next section, which addresses Evaluation Question 3.

> **Conclusions**: The USRA program is consistent with the federal government's S&T strategy, NSERC's strategic outcomes and NSERC's Strategy for Partnership and Innovation (SPI).

Question 3: Is there a necessary role for the federal government in delivering the USRA program?

The S&T strategy (Government of Canada, 2007) states that the role of the federal government in 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 fulfills 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, 2011).

As discussed in the previous section, the USRA program contributes to NSERC's mandate by supporting the next generation of scientists and engineers. However, the role of the federal government in delivering the USRA program is strengthened if the need that it addresses is not currently being met through other means. An assessment of the federal government's and NSERC's roles in delivering the USRA program therefore included looking at whether or not there are other similar programs, and whether these duplicate or complement the USRA program.

University supervisors, awardees and university liaison officers, as well as organizations that had participated in the IRDF/PDF program, were asked to identify programs that they considered to be similar to the USRA program. One in five awardees (20%) and one in three university supervisors (34%) were aware of other programs that they considered to be similar to the USRA program, but no single award opportunity was mentioned by more than 1% of award holders. The most frequently mentioned programs were university-specific programs (i.e., summer research awards, internships, or co-op programs). Most programs identified by liaison officers were provincial or regional (e.g., Quebec Fund for Research on Society and Culture (FQRSC), Quebec funding for health research (FRSQ), the Ontario Centre of Excellence, and the Northern Scientific Research Program). Organizations surveyed as part of the IRDF/PDF evaluations exclusively referenced university co-op programs.

A total of 23 programs were identified by the evaluation at the national and provincial/regional levels: 16 national programs (15 in universities and 1 in industry) and 7 provincial/regional programs (5 in universities and 2 in industry). It is conceivable that other programs exist that were not captured in the review; however, the fact that both university supervisors and students were unaware of other funding opportunities suggests that the evaluation managed to identify the most important funding alternatives on the national and provincial/regional levels.

A number of university-specific programs were also identified. There are likely, however, many other university-specific programs that exist in Canada that were not captured by the review.

Results of this review of other funding programs for undergraduate science and engineering students suggest that although other programs exist, none are as inclusive, nor of the same scale and scope, as the USRA program. The USRA program appears to be the only one that offers research opportunities to undergraduate students in all NSE disciplines, is national in scope, and offers the option of research experience in a university or industrial setting.

Other University Research Programs for Undergraduate Students

The following is a summary of other programs that provide undergraduate students with research work terms in a university setting. Table 5 provides an overview of the number of programs identified by geographical scope and discipline.

National programs. All of the national undergraduate research programs (15) were restricted to a particular discipline or area of research (*Canadian Blood Services Summer Internship Program, Child and Family Research Institute Summer Students' Research Program*), and were either health science related (12) or focused on specific areas of science (3). The health science programs were offered primarily through non-profit and charitable organizations, with a limited number of awards. Health-related award programs for undergraduate students are relevant to NSE students as their educational profile makes them eligible to apply. These programs are designed to attract NSE undergraduate students to specific areas of health research early in their academic career.

Provincial/regional programs. Some of the undergraduate research programs (7) were restricted to students attending university within a particular province or region (*B.C. Clinical Genomics Network Award)*. Three of these programs were restricted to students in a health-related discipline (*Heart and Stroke Foundation of Ontario, Alberta Heritage Foundation for Medical Research Summer Studentship, Quebec's Summer Program for Students in Medicine and Health Sciences*).

University-specific programs. Programs available only to students at particular universities tended to be of three types: funded by the university and open to students across multiple disciplines; funded by specific faculties and open to students within those faculties (*Faculty of Nursing Summer Undergraduate Research Program, Faculty of Engineering Summer Undergraduate Research Program*); or funded by external organizations, and targeted at students within particular disciplines or research areas (*University of Toronto Charles Hollenberg Summer Studentship Program*). University-funded programs were generally small in scale and in many cases, were created by the universities to meet the high demand for USRAs by supplementing their award quota. Programs funded by organizations external to the university tended to have other restrictions, in addition to the discipline or topic areas (e.g., year of study).

Table 5: Programs similar to the URU program

Geographical Scope	Discipline			
	Only NSE disciplines	Specific NSE disciplines	NSE and other disciplines	Total
National	0	3	12	15
Provincial/regional	1	4	0	5
Total	*1*	*7*	*12*	*20*

Other Industry Research Programs for Undergraduate Students

In Canada, the most comparable undergraduate programs to the URI are co-op programs. Similar to URI, they offer a paid work term in industry directly related to the student's field of study. The one significant difference between co-op programs and the URI is the fact that co-op programs focus on work experience and do not necessarily have a research component. The following is an overview of co-op programs, as well as other initiatives, that enable undergraduate students to gain research experience in an industry setting. Table 6 summarizes the number of programs identified by geographical scope and discipline.

National programs. There is only one program that offers industry-related experience to undergraduate students across Canada. The National Co-op Program (NCP), funded through the National Research Council, is jointly administered through Canadian universities and colleges and cégep co-op offices, and is therefore restricted to those universities offering co-op programs. While the NCP shares some similarities with URI, it does not have a research component, and is only accessible to students in disciplines for which a co-op program exists.

Provincial/regional programs. Programs that have some similarities to the URI are the *Ontario Centre of Excellence (OCE) Connections' Program* and the *MITACS Enterprise program.*[3] Both of these programs provide extensive practical experience to undergraduate students through their involvement with Ontario industry. The Connections program alone supports more than 1,500 students annually from 20 universities/colleges across Ontario in over 320 industry projects. The *Connections and Enterprise* programs are run in conjunction with existing college and university curricula throughout the year. In addition to their geographical restrictions, these programs limit eligibility to undergraduate students in their final year.

University-specific programs. Undergraduate co-op programs are offered in many universities in Canada (*Social, Ecological, Economic Development Studies program at the University of British Columbia*). Not all universities, however, offer co-op programs to NSE students or for all disciplines within the NSE. Co-op programs may also be restricted to particular years of study.

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[3] While other MITACS funding programs exist, they are at the postgraduate level.

Table 6: Programs similar to the URI program

Geographical Scope	Discipline			
	Only NSE disciplines	Specific NSE disciplines	NSE and other disciplines	Total
National	1	0	0	1
Provincial/regional	2	0	0	2
Total	*3*	*0*	*0*	*3*

Conclusions: The USRA program was created to help NSERC meet its mandate to support the next generation of scientists and engineers across Canada. Due to the target populations served by other undergraduate programs, and in many cases, their narrow focus and small scale, these programs tend to complement rather than duplicate the USRA program.

2   KEY FINDINGS – DESIGN AND DELIVERY

Question 4:   What is the optimal value of the award for attracting and supporting students?

Currently, USRA holders receive a minimum of $5,625 for 16 weeks of full-time research at a university. That represents $9.38/hour for a 7.5-hour work day, which is lower than the minimum wage in all Canadian provinces and territories ($9.95 on average) (Human Resources and Skills Development Canada). In light of this, the evaluation explored what an appropriate award level would be for attracting and supporting students.

Students who held an award in 2009 or 2010 were asked to indicate how much they were paid for their USRA work term. According to USRA holders, on average, they were paid more than the minimum value of the award (Table 7). URU holders reported that they had received about $1,000 more than the minimum, and URI holders, about $3,700 more on average for a 16-week work term. The award amounts students reported when completing the exit survey were almost identical, even though these students had held their awards between 1999 and 2006. University supervisors, on the other hand, indicated that URU holders had received $1,700 more on average, which was slightly higher than the amount reported by the award holders themselves.

Views were mixed regarding the optimum level of support. Half of the awardees and university supervisors thought that the current minimum level was appropriate, and half thought it should be higher. Former URU holders who thought it should be higher suggested about $2,600 more than the current level, and researchers, about $2,100 dollars more on average. URI holders suggested about $3,500 higher than the current minimum level. The main reason that researchers and awardees sought a higher award level was to raise it beyond minimum wage (96% of awardees and 60% of university supervisors). A portion of these respondents also thought that the amount should be the same as what undergraduate students are paid for other work terms (41% and 25%) or what teaching/research assistants are paid (21% and 25%). In response to an open-ended survey question, some also indicated that the award level should be reflective of the cost of living (7% and 9%) and the cost of education (9% of awardees).

Table 7: Value of the USRA award (16-week averages)

Value of the Award	Average for 16 weeks	n
Current value		
Current minimum value	$5,625	N/A
URU according to awardees (2009-2010)	$6,608	1,928
URU according to awardees (1999-2006)	$6,563	3,713
URU according to university supervisors	$7,321	825
URI according to awardees (2009-2010)	$9,281	338
URI according to awardees (1999-2006)	$9,602	237
Desired minimum value		
URU according to awardees	$8,202	1,198
URI according to awardees	$9,131	196
URU according to university supervisors	$7,732	598
Value of other opportunities (i.e., highest paying job)		
Field of study according to awardees	$10,166	1,067
Not in field of study according to awardees	$8,423	629
According to industry	$9,633	55

The pay for other undergraduate jobs varied depending on whether or not they were in the students' field of study. Those who held an award in 2009-10 indicated that on average, they had received about $4,500 more from their highest paying job in their field of study than was paid by the USRA work term. Jobs that were not in their field of study paid $2,800 more on average, according to award holders. Industry reported paying undergraduate students that they hired $4,000 more than the amount paid by the USRA work term. It is also worth noting that undergraduates working for the federal government are paid a minimum of $12.21/hour (which represents $1,701 more for a 16-week work term) (Treasury Board Secretariat, 2007). One of the USRA Liaison officers explained that researchers often consider a range of factors when deciding how much to pay URU holders, such as their own research budget, the student's year of study, type of work the student is hired for and skill requirements.

While other opportunities seemed to pay more than a USRA work term, only slightly more than half of awardees (58%) had actually held another job in their field of study. This may explain why both URU and URI holders described their pay as being competitive. Four in ten (44%) thought that the USRA work-term pay they received was very competitive and two in ten (18%) indicated that it was somewhat competitive.

Most students indicated that they did not accept a USRA on the basis that it offered higher pay than other opportunities. This was an important consideration for one in five (20%) students. Other factors were more important, such as the opportunity to work in a research environment (70%), the opportunity to engage in work related to their education (69% URU; 52% URI), and

engaging in work that was linked to their career goals (69% URU; 50% URI). Even though money was not the most important reason for accepting USRAs, the award does play a significant role in supporting students financially during their studies, as it represents as much as 61% of their personal annual income on average. The financial importance of the award to students is illustrated by the following quote from a former USRA holder who completed the survey:

> Participation in the USRA program has arguably been the single most important event in my career path so far. It also helped me get through university without debt. I am very grateful for the opportunity and very supportive of the program.

Conclusions: USRA holders, particularly those working for industry, are paid more than the minimum value of the award on average, but less than what other opportunities pay. Half of students and industry supervisors think that the minimum value of the award should be higher, mainly to ensure that it is higher than minimum wage, but also to make the pay more competitive in relation to other job opportunities. The importance of ensuring that the value of the award is at least equivalent to minimum wage was underlined by the fact that the award represents almost two thirds of students' personal annual income on average. The pay level required to attract students to a USRA varies based on factors such as discipline, year of study, type of work, skill requirements and other individual circumstances.

Question 5:   How have universities selected awardees?

NSERC has established the eligibility criteria for receiving a USRA award. Awardees must be Canadian citizens (or permanent residents), have a cumulative average of at least B-, and have completed their first year of university. Universities establish their own selection criteria within the broad guidelines established by NSERC; namely, the student's academic record and aptitude for research. Universities are also free to design their own selection process. In order to determine whether NSERC supports excellence through the USRA program (i.e., funds top students), the evaluation examined the selection criteria and process used by ten selected universities.

Allocation of Awards

NSERC allocates a quota of USRAs to each university eligible to participate in the program. Half (10) of the liaison officers interviewed stated that their institution distributed its quota across departments to ensure equity for departments, researchers and students. Various formulae and strategies were used for calculating the number of awards per department; these were based on determinants such as the size of the department, the proportion of Discovery Grants held by a particular department, and the anticipated number of USRA candidates per department based on historical usage. All but one of the universities that distributed USRAs

across departments was a large university.[4] The remaining universities did not establish quotas for departments. Instead, they issued an open call across their campuses, and NSE students in any department that met NSERC's eligibility requirements could submit applications.

Selection Processes

The selection processes used by the twenty universities for which interviews were conducted can be characterized as either *centralized* or *decentralized (*or a *hybrid* of the two*)*.

Universities using a *centralized* selection process had a single selection committee, composed of the USRA liaison officer and faculty representatives, which received and reviewed all USRA applications. University liaison officers assumed a significant role in universities with a centralized selection process. Their responsibilities included advertising and providing information about the award program, determining the number of eligible supervisors who would be willing to supervise students, responding to student and faculty queries about the application process, reviewing applications, and participating in the selection committee. GPA was generally the selection criteria used by universities with a centralized selection process. Supervisor involvement was minimal until the student to be supervised was awarded. The following quote aptly describes one university's centralized approach to USRA selection:

> Once the applications are received by [the USRA Liaison Office], we do two separate spreadsheets. We do a listing of all applications by department and then alphabetically by student names, so they know who is applying to which department. And then we do another spreadsheet that has a number of different criteria on it but it's sorted by the students' cumulative average of their courses, so the highest average student is on top and they are ranked numerically down from that.

Institutions using a *decentralized* selection process had individual departments and/or faculty identify and select potential USRA candidates. The lists of successful candidates were then shared with the liaison officer. Those universities taking a decentralized approach to selection had students submit their applications either to the department or to their potential supervisor. Supervisors would identify and contact students they were interested in working with and suggest that they apply. In contrast to universities using a centralized approach, departments and supervisors were far more involved and had considerable discretion in the selection process. One university described its decentralized approach in the following way:

> [The departments] run their own internal competition, and my understanding is that most of these competitions are very similar. Each department holds its own competition, and a committee within each of those departments will review the applications, they'll look at transcripts, and so on, and then they award the USRAs

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[4] The definition of a large university for the purposes of this evaluation is based on a three-year average of NSERC grant and scholarship expenditures exceeding $13,981,876.

to the students. The departments then send all of the paperwork to our office, and we go through the application forms to ensure all the bits and pieces are there.

Universities with a decentralized selection process appeared no more likely to allocate quotas to departments than universities that used a centralized selection process, but they tended to use other selection criteria or screening tools beyond the cumulative average. This included student resumes, essays describing the student's interest in research, interviews with potential supervisors, as well as the nature of the student's program and course selection and its relevance to the research project.

A few universities (3) used what can be described as a *hybrid* of a centralized and decentralized selection process. Their processes allowed faculty or departments to help identify potential candidates before a centralized committee made the final award decisions.

Universities with a decentralized or a hybrid selection process suggested that this worked best as it allowed those researchers most familiar with the students to have significant input in the selection process. This was described by one of the liaison officers:

> One positive aspect of the [decentralized] selection process is that departments have their own selection criteria, and are given the flexibility within a certain year and pool of applicants to determine their internal rankings and who receives a USRA.

All of the liaison officers interviewed stated that there were always more USRA applications than there were awards available. However, this was more of an issue for universities utilizing a centralized selection process. With so few awards and competition being so high, the centralized approach could potentially result in a greater number of students applying unnecessarily. As one university explained:

> NSERC's minimum average is fine, and that's what we advertise, but our lowest average this year from all applicants was 84%. We never have a problem where we have to turn anyone down in terms of meeting the minimum grade average.

For this reason, some universities raised their GPA requirement beyond the minimum B- to a B or B+. Universities using a decentralized selection process, on the other hand, had other screening mechanisms in place, faculty involvement being foremost, and this allowed researchers to screen out some potential applicants whose GPA was not competitive. As a result, those departments and/or faculties had more control over the number of applicants, and there was less of a gap between the university's USRA quota and the number of applications.

Other Variations in Eligibility Criteria and Program Delivery

Beyond differences in their selection processes, other variations among universities in terms of eligibility criteria and delivery of the program were also observed. For at least five of the universities, students had to have completed their second year, and in two cases, preference was given to third- and fourth-year students. The rationale for not accepting first-year students included their lack of experience and the difficulty of fairly assessing their cumulative average, having just completed one semester. Students closer to their graduate studies were in greater

demand because they were considered to be more experienced. A further consideration was that first-year students would have other opportunities to apply for a USRA in subsequent years.

Most of the universities offered the USRA program to students in the summer term only. Those universities (5) that delivered the program over three semesters – summer, fall, winter – tended to have structures already in place, such as work-term or co-op programs, to accommodate delivery beyond the summer months.

Although few external applications were received, all universities interviewed as part of the evaluation indicated that they accepted applications from students at other universities. Most liaison officers stated that they generally received one or two external applications per year, although two of the liaison officers from larger institutions reported they received about 25 per year. The reasons USRA holders chose to apply to a different university varied. Some wanted to work with a particular professor, while others simply wanted to be close to their family over the summer. An analysis of USRA administrative data confirms that it is relatively rare for students to hold a URU at a university other than their home university. Out of all URUs held between 1999 and 2010, only one in 15 (7%) was held at a university other than the home university.

External applicants appeared less likely to be selected for a USRA than internal applicants because they often did not have a pre-existing relationship with faculty. The lack of first-hand knowledge of the student led faculty to favour internal candidates. One liaison officer stated: "Some faculty members think they should find jobs for our own students given the economy"; another indicated that preference is given to students enrolled at [their university]. As noted previously, faculty often played a key role in identifying and selecting USRA holders at universities with a centralized selection process.

Conclusions: One of the commonalities across all of the universities interviewed was a high demand from highly qualified students for a relatively small number of awards. For this reason, despite there being variations in universities' selection processes and eligibility criteria, students who received an award had high GPAs. Universities with a centralized selection process identify the top students to receive USRAs largely on the basis of GPA alone. Universities using a decentralized selection process, on the other hand, have much broader criteria for determining who the top candidates are. In addition to GPA, departments and/or faculties take into consideration a range of factors, including first-hand knowledge of the students' capacity to conduct research.

Not having a pre-existing relationship with faculty constitutes a barrier for some students applying for a USRA at a university other than their own.

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3   KEY FINDINGS – EFFECTIVENESS

This section assesses the effectiveness of the USRA program. The effectiveness of a program is defined as the extent to which it is achieving expected outcomes or demonstrating progress toward achieving them.

Question 6:   To what extent have awardees obtained R&D work experience and skills?

Experience and Skills Gained

Awardees reported that they were most frequently involved in analysis of results (80%), collection of data in the field or lab (75%), preparation of written material (75%), and use of laboratory equipment and instruments (73%) (Figure 3). Slightly more than half participated in research design (66%), project management (59%) and technical support activities (57%). It was less common for awardees to present research results at conferences (32%), provide administrative support in the context of research (27%), manage research databases (26%) or contribute to publications of research results (25%). Results from the surveys of university and industry supervisors provided a similar picture of awardees' involvement.

Figure 3: Activities awardees participated in during their work terms
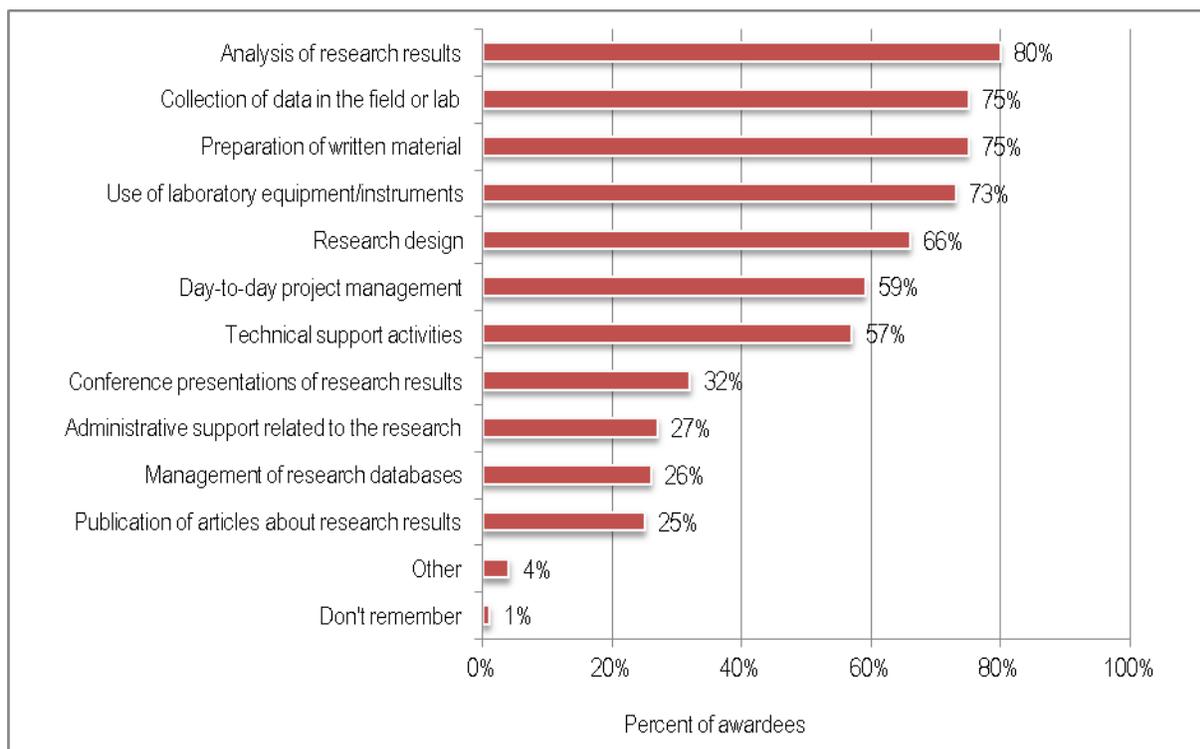
Source: Awardee follow-up survey 1999-2006, 2009-2010 (n=6,471)

Overall, three out of four awardees (76%) considered the work term to have been very challenging, and awardees gained many skills as part of their work terms. It was most common for them to report having gained technical skills, including knowledge of the discipline (93%), analytical techniques (76%), experimental methods (75%), and use of laboratory equipment and instruments (72%) (Figure 4). A majority also gained critical thinking skills (75%), and more than half said that they had improved in terms of personal time management (64%), writing reports and publications (57%) and communication skills (52%). Less than half said they had improved interpersonal skills (48%), project management skills (46%) or oral presentation skills (42%). A majority of awardees indicated that they had used the particular skills (or knowledge) they gained in their subsequent university education and/or research career (between 75-80% depending on the particular skill). Awardees reported similar skills improvements in the exit survey as in the follow-up survey.

Figure 4: Skills gained according to awardees
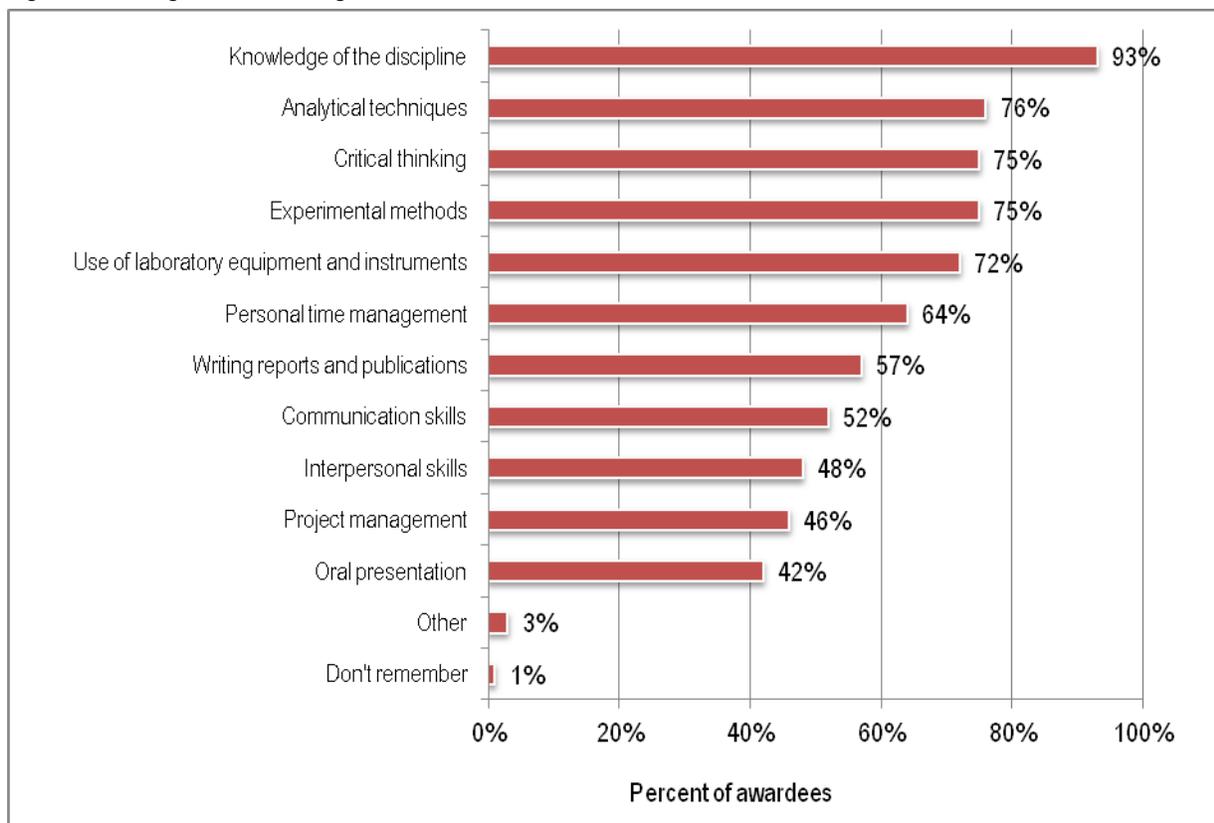
Source: Awardee follow-up survey 1999-2006 (n=3,808)

While these survey results suggest that awardees have obtained R&D skills to a high extent, it is important to remember that this is self-reported data, interpreted in the absence of a comparison group. Other studies of undergraduate research programs that used comparison groups have concluded that participants largely gain improved confidence and communication skills (Ward, Bauer & Bennett, 2005; Russell et al, 2007). Only modest gains were found in the

areas of critical thinking and scientific analysis, and there was inconclusive evidence regarding higher-level research skills such as identifying a research question, proposing experimental design or developing more complex understanding of the nature of scientific knowledge (Ward, Bauer & Bennett, 2005; Russell et al, 2007). It is possible that the skills USRA holders reported gaining were perceived rather than real in some cases. Nevertheless, the exposure could still have made them more interested in research and more knowledgeable about what a research career entails (i.e., the next level of expected program outcomes). In other words, the program could still demonstrate effectiveness overall, even if awardees did not gain R&D skills to a high extent. A comment from a former USRA holder who completed the survey illustrates this point exactly:

> The most significant thing I gained through my USRA was direct exposure to the practice of scientific research. Without experiencing this first-hand, it would have been difficult for me to appreciate the experiences and skills that I could obtain in post-graduate studies. The analytical, communication, and leadership skills I have been able to develop as a post-graduate student will be invaluable to me wherever my career takes me. It was during my USRAs that I first realized that the potential for this type of training existed in academia.

Awardees responding to the survey also felt that the skills they gained contributed to their career. When completing the exit survey, a majority (70%) of award holders agreed that their USRA experience improved their prospects for obtaining a permanent job in a relevant area, but when asked the same question on the survey that was conducted as part of the evaluation, their views were more mixed. Slightly more than half (58%) felt that their USRA experience improved their prospects of landing a permanent job in a relevant area, with more URI holders expressing this view than URU holders. The same proportion felt that the USRA work term was important in obtaining their current job, and three quarters (74%) felt that the skills and knowledge made them better prepared for their current job.

Value Added from Holding Multiple Awards

About 43% of awardees who responded to the follow-up survey had completed more than one USRA work term. Those who had held more than one USRA were more likely to say that the USRA experience helped them to choose their graduate program, major, courses, electives and thesis topic. They were also more likely to say that the USRA experience was very important in helping them obtain their current job, and that it made them very prepared for their current job.

Among students who held more than one award, about a third (35%) held the awards with different supervisors in the same organization, and a quarter (25%) with a different supervisor at another organization (Table 8). URI holders (40%) were more likely than URU holders (19%) to have held their USRAs at different organizations with different supervisors. This is not surprising considering how rare it is for students to hold a USRA at a university that is not their home institution (discussed under Evaluation Question 5).

Table 8: Students with multiple USRA awards

Awards were with…	Percent of award holders			
	URU (n=1,396)	URI (n=178)	URU/URI (n=78)	Overall (n=1,652)
Same organization and supervisor	40%	44%	3%	39%
Same organization, different supervisor	40%	11%	1%	35%
Different organization, different supervisor	19%	40%	95%	25%
Different organization, same supervisor	1%	2%	1%	1%
Don't remember	1%	3%	-	1%
Total	*100%*	*100%*	*100%*	*100%*

Source:Awardee follow-up survey, 1999-2006

Those who had completed their USRAs with different supervisors were asked to explain how the diversity had added value to their experience. Awardees most frequently highlighted that they gained exposure to different types of research (35%). This was followed by exposure to different management styles (18%) and different approaches to research (17%). Some awardees had also gained different skills (17%) and new contacts (9%) and were, through their experience, in a better position to make career decisions (9%) and know what to look for in a supervisor (5%). A comment made by a past USRA holder illustrates this:

> As my supervisors worked on different projects, I learned a completely different set of skills and knowledge in those areas. However, I also learned some important lessons about dealing with different types of superiors in a workplace. Both were excellent supervisors, but are very different people.

Figure 5: Value added from holding awards with different supervisors
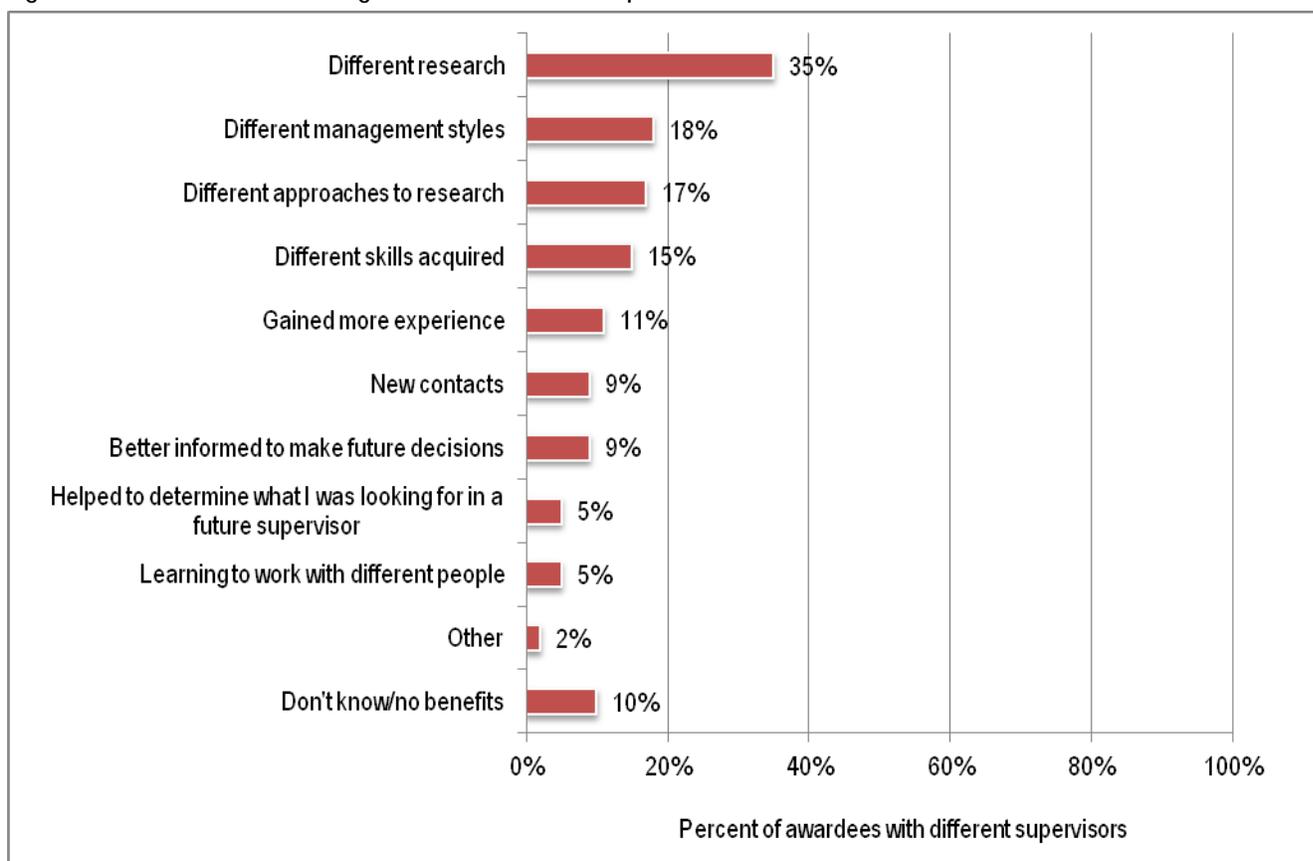
Note: The percentages appear low as respondents highlighted these benefits as part of an open-ended rather than close-ended survey question. Some respondents may have mentioned more than one benefit.

Source: Awardee follow-up survey 1999-2006 (n=573)

Awardees that had completed their USRAs with different organizations and different supervisors highlighted similar benefits, including exposure to different types of research (24%), different approaches (7%), and different environments (13%), in particular exposure to both industry and university research environments (8%). They also gained more experience (14%), skills (8%), and a broader professional network (10%), and were better informed to make further career decisions (13%). A former student who held USRA awards both in industry and at a university stated that:

> [the experience] broadened my views and allowed me to compare my experience in the industry and in academia. Both supervisors I have had were very helpful and knowledgeable in their respective fields and they were both willing to share their skills and experience with me so I could advance my knowledge. These experiences have allowed me to choose my career path more clearly; in addition, they also assisted me with my career development.

Students who chose to work with a different supervisor for their second or third USRA primarily did so because they wanted to gain different (30%) or broader (23%) research

experience and find an area in which they were more interested (13%). Other students chose to go with the same supervisor because they wanted to continue doing the same type of research (33%) and had already had a positive experience and existing relationship with the supervisor (17%) and the team (10%). The importance students place on having a strong mentoring relationship with their supervisor was also highlighted by other survey results. When award holders were asked to identify additional benefits resulting from their work term, the single most important benefit was to connect with mentors (15%).[5] One USRA holder explained:

> I think that one-on-one mentoring is nearly impossible for undergrads in big universities to access and yet it is probably the first thing someone would mention as the most enabling factor in their success. USRA gave me the opportunity to have that one-on-one mentoring.

About one in four awardees with multiple awards (23%) did not have a choice as to which supervisor they would work with when accepting their second or third USRA.

Conclusions: While awardees believed that they had obtained a wide range of skills useful to their subsequent career and education, the most significant contribution of the experience may have been exposure to the research environment. Multiple awards, particularly with different supervisors or organizations, added value to the students' research experience.

Question 7:   To what extent have awardees become more interested in research in the NSE and more knowledgeable about what a research career entails?

Question 8:   To what extent have awardees become more motivated to pursue a research career and to undertake graduate studies in the NSE?

Evaluation questions seven and eight are closely related and the findings for those questions are therefore reported in the same section below.

Only four in ten (39%) award holders experience an increased interest in R&D as a result of their work term (Table 9). It was just as common for the work term to have sustained their high level of interest. Similarly, almost half of URU holders (46%) reported that the award increased their interest in a career in academia, and it helped 36% to maintain their high level of interest in such a career. A third of URI holders (34%) experienced an increased interest in a career in industry, and the award helped more than a third (41%) to maintain their interest, according to the exit survey results.

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[5] The proportion that raised this issue can be considered high because it was raised by respondents spontaneously, without prompting, given that the survey did not include explicit questions on this topic.

Table 9: USRA holders' interest in R&D

Interest in R&D	Percent of award holders		
	URU (n=19,111)	URI (n=1,892)	Overall (n=21,003)
Increased my interest	39%	40%	39%
Maintained my high level of interest	40%	41%	40%
Maintained my low level of interest	7%	7%	7%
Decreased my interest	6%	5%	6%
Do not know	7%	7%	7%
Unknown	0%	0%	0%
Total	*100%*	*100%*	*100%*

Source: Undergraduate Student Research Award Exit Survey, 1999-2010

On the awardee follow-up survey, about three quarters agreed with the statement that the work term increased their desire to pursue graduate studies (77%) and a research career (74%). This does not, however, necessarily mean that the program had more of an impact on awardees' desire to pursue graduate studies and a research career than on their general interest in R&D. The survey questions used to assess the program's incremental impact on motivation used a different response scale that did not give respondents the option to state that the work term had simply maintained their current motivation. It was therefore not surprising that only a small portion of students made tangible changes to their educational plans as a result of the work term. Upon completion of the work term, just over a quarter of USRA holders (28%) had changed their educational plans in order to stay in university longer than they originally planned as a result of their USRA experience. The USRA program's limited impact on awardees' interest in R&D and educational plans is likely due to the fact that USRA students are already above average when it comes to academic achievements and aptitude for research (discussed further under Evaluation Question 9). Similarly, other studies reviewed as part of the literature review did not support the notion that undergraduate research programs make top students more likely to pursue a research career in the NSE, and suggested instead that these programs primarily confirm students' already existing aspirations for graduate studies and career directions (Seymour et al, 2004; Hunter et al, 2006). However, based on student reports, the authors did find that the programs had a significant impact on students' emergent identities and sense of direction. In other words, undergraduate research experiences helped students to build confidence, personal growth and self-understanding, better preparing them to take the next steps, especially in decisions regarding graduate school. The authors concluded that a focus on extrinsic measures of student success (e.g., changes to educational and career plans), runs the risk of not detecting the real value added to students' undergraduate education.

The USRA program does appear to make a significant contribution to preparing students for a research career because of their exposure to research environments and the experience they gain

(as discussed in the previous section). A past URU holder explained how the experience can prepare students for graduate school:

> My USRA experience was invaluable as an introduction into research. I collected my own data, analyzed, wrote about it, and then got feedback from experts in the field. It was a good taste of what to expect in graduate school. […]

Both university supervisors (99%) and industry supervisors (95%) also confirmed that awardees' understanding of what is involved in a research career improved as a result of the work term. Other studies of undergraduate research programs echo these findings. Although largely reliant on faculty and/or student reports, they conclude that the programs improve the students' awareness, confidence, and understanding of what a research career entails (Hancock et al, 2008), as well as shape their science identities and socialize them into the scientific profession (Thiry et al, 2011).

Conclusions: Only a portion of award holders experience an increased interest in R&D or decide to change their educational plans as a result of the award. It is just as common for the USRA to help sustain awardees' interest in R&D as to increase it. The USRA makes awardees more motivated to pursue a research career and somewhat more motivated to work in academia or industry. Awardees' exposure to research, and possibly the skills they gain, makes them more knowledgeable about what a research career entails.

Question 9:   To what extent do awardees undertake graduate studies and pursue a career in the NSE?

Three quarters of awardees planned (75%) to go to graduate school when they completed the exit survey, a slightly higher portion (85%) applied and almost all who applied (99.4%) were accepted, according to the follow-up survey results. This makes USRA students more likely than other students in the NSE to undertake graduate studies. According to Statistics Canada's *National Graduates Survey*, only one in five NSE bachelor graduates pursues graduate studies (27% of the 2000 graduates and 28% of the 2005 graduates), and even fewer pursue graduate studies in the NSE (14% of the 2000 graduates and 13% of the 2005 graduates). However, it is the characteristics of the students who receive a USRA that make them more likely to enrol in graduate studies than the research work term.

Students of a high academic calibre with a strong interest in research are more likely than other students to receive a USRA in the first place. In accordance with NSERC guidelines, universities use "the student's academic record and aptitude for research" as the basis for their selection criteria, and the selection process at the university is generally very competitive due to high demand for the awards (as discussed under Evaluation Question 5). The academic calibre of URI holders is also relatively high, even though NSERC grants all students with a B- or higher a URI. USRA holders' high academic calibre is also evident in that they have a significantly higher success rate than other applicants to Canada Graduate Scholarships, Vanier Canada

Graduate Scholarships and Postdoctoral Fellowships. (The higher success rate may, of course, be partly due to the award.) A significant portion of USRA holders had also received other undergraduate awards or scholarships from their universities (68%) or other organizations (50%). University supervisors (97%) confirmed that the USRA students' academic achievements are above those of the average student, and a majority of industry supervisors (83%) said USRA students performed better on the job than other students they had supervised.

Currently, most awardees from 1999-2006 either work full time (54%) or attend school full time (40%). Of those who had completed their graduate studies in 2011, just over half graduated with a Master's degree (54%), while just under half graduated with a doctorate (46%). Of those working full time, 40% work in the private sector, 35% at a university and 23% in government. Fewer than one in ten (7%) URI holders working full-time previously held a USRA with their current employer.

While the USRA program did not generally redefine most top students' career paths, the award did appear to contribute to it in a significant manner. A comment from a past USRA holder illustrates this:

> The USRA undoubtedly contributed to my success at receiving external awards to support the majority of my graduate training. Monetary value aside, this snowball effect, beginning with the USRA, has had a major impact on my CV and my confidence as a researcher and significantly contributed to my success at landing a very attractive postdoctoral position. Of course, each of these events, in turn, led to a greater chance at securing an academic position. I honestly believe that if I did not receive the USRA, I would not have been so lucky in the graduate award competitions and I may not have made the career decisions that I have.

The survey results indicate that at least half of past USRA holders pursue a career in the NSE. Half of awardees working full time (47%) spend at least half of their time on R&D, while one third (35%) spend less than half of their time on R&D. Half of the awardees (47%) working full time have worked in R&D in the past, not counting their current employment. A majority of those not working full time consider themselves likely to focus their future career on research in the NSE (79%) and hope to spend at least half of their time on R&D in the future (69%).

A majority of former award holders continued their studies (83%) and their career (72%) in the NSE (Table 10). Some continued their studies (12%) or career (18%) in health sciences, which is a reflection of the close relationship between health sciences and the NSE.

Table 10: Field of graduate program and field of work

Discipline	Percent of award holders	
	Field of graduate program (n=3,078)	Field of current work (n=2,048)
Natural sciences and engineering	83%	72%
Health sciences	12%	18%
Social sciences and humanities	2%	1%
Other	3%	9%
Total	*100%*	*100%*

Source:Awardee follow-up survey, 1999-2006

Conclusions: Award holders are more likely than other students to undertake graduate studies, but not necessarily because of their USRA experience. At least half of awardees pursue a research career in the NSE.

Question 10: How and to what extent do researchers and industry host organizations benefit from the USRA program?

The USRA program is primarily intended to aid students, but also provides benefits to the researchers and industry host organizations that supervise them. The evaluation explored these benefits in order to provide a more complete picture of the impact of the program.

The majority of USRA liaison officers believed that the main benefit of the USRA program for researchers was having highly qualified students to assume some of the work associated with their research project. One liaison officer stated: "These are strong students; it's easier to get work done when you have capable students working on the project." University supervisors surveyed agreed that USRA students increase their research productivity (75%), complete research more efficiently (75%), contribute to published research (74%), provide valuable insights on research (73%), and complete aspects of their research project that would otherwise not have been completed (70%). Both liaison officers (4) and university supervisors (22%)[6] thought that faculties' research productivity would decrease if the USRA program did not exist, as fewer students would be hired. One university supervisor stated that:

> The student allowed me to try novel methods that I otherwise would not have had the opportunity to investigate. The success of the student resulted in 2 papers and a new direction for part of my lab.

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[6] The proportion that raised this issue can be considered high because it was raised by respondents spontaneously, without prompting, given that the survey did not include explicit questions on this topic.

Liaison officers and university supervisors also felt that the USRA provides an opportunity for supervisors to learn first-hand whether the student is someone they would want to work with at the graduate level and whether the student is well suited to graduate work. More than half of university supervisors (60%) stated that they use the program as a tool to recruit graduate students. Some university supervisors (9%) and liaison officers also felt that the program improved the university's reputation as a research institute.

The benefits that industry organizations experienced as a result of hosting USRA students were similar to those noted by university supervisors. The vast majority of industry supervisors agreed that USRA holders contributed to their organization by making it possible for them to complete their research more efficiently (92%) and by improving their research productivity (94%). A majority agreed that USRA holders worked on aspects of the research that would not otherwise have been completed (77%). This seemed to be particularly important for companies with limited resources for R&D. One industry supervisor explained:

> Being a small company, assistance from programs like USRA is very important in helping advance the progress of our new product research and development. We may not have the opportunity to hire student researchers without these programs, and therefore are not able to complete projects as quickly as we would like.

A majority of industry supervisors also agreed that the students provided valuable insights regarding their research (71%) and that the USRA program functions as a means to recruit new employees (72%). One industry supervisor explained:

> We were able to advance research methodology and technology transfer of methodology because (the) student was aware of state-of-the-art methodology and processing techniques. In addition, the student was able to see standard industry practice for educational purposes, as well as provide suggestions for improvements. We have also now hired the student upon graduation and he started well ahead of where a recent graduate would have, based on his research experience within our organization.

Slightly more than one in three organizations (37%) had hired a former USRA holder and almost one in five (18%) had hired more than one. Most industry supervisors (82%) also said that they are likely to participate in the USRA program in the future, which suggests that they see continued value in hiring USRA students.

University and industry supervisors also reported that they gained personal benefits from being involved in the program. Supervising USRA students increased their management or training skills, brought new ideas and energy to the workplace and contributed to their overall feeling of job satisfaction.

The results from the survey of organizations that have participated in NSERC's IRDF, CRD and IRC programs provided some insight into why some organizations choose not to participate in the USRA program. Most respondents (80%) did, however, work for an organization that had participated in the program. The main reason (32%) that some organizations had decided not to

sponsor a URU work term was that the length of the work term (16 weeks) was too short to make it worthwhile (Table 11). Only three respondents indicated what duration would make it worthwhile for them to participate; two respondents suggested six months and one respondent suggested twelve months. Another important reason some organizations did not participate in the USRA program was that they had no need to hire students at the undergraduate level (23%). All respondents from organizations that had not participated in the USRA program had, however, heard of the program and about three quarters (74%) stated that the USRA program was at least of some interest to their organization.

Table 11: Reasons for not participating in the USRA program

Response	Percent of respondents (n=65)
The time period for which the organization can be reimbursed is too short	32%
No need to hire students at the undergraduate level	23%
Other undergraduate student programs better meet the organization's needs	19%
The reimbursement amount from NSERC is too low	11%
Other	35%
No response/Don't know	15%

Note: Respondent could select more than one answer. No particular themes emerged from the responses of respondents who indicated "other."

Source:Survey of organizations participating in NSERC's IRDF, CRD and IRC programs

Conclusions: The USRA program contributes to researchers' productivity and gives them an opportunity to recruit and assess students for graduate studies. The USRA program helps industry improve research productivity and recruit new employees.

4   KEY FINDINGS – ECONOMY AND EFFICIENCY

Question 11:   To what extent are the most effective and efficient means being used to achieve program outcomes?

A program is efficient when it produces outputs at a relatively low cost. This means that the USRA program is efficient if the cost of awarding and administering the awards is low and the activities are carried out in an effective manner. A program demonstrates economy if it is delivered efficiently and the outcomes are produced at a low cost. As part of assessing the program's economy, the evaluation looked at industry host organizations' compliance costs and the possibilities of having universities pay a higher top-up, as well as alternative means for achieving program outcomes.

Program Costs and Operating Ratio

One way to assess the efficiency of the USRA program is the ratio of the administrative costs to the total grant funds awarded (i.e., the operating ratio). An estimate of administrative costs for the USRA program was only readily available for nine of the ten years under review (fiscal years 2001-02 to 2009-10) (Table 12). For fiscal years 2001-02 to 2010-11, the operating ratio was 4.6%. The average operating ratio was the same for both URU and URI, and the annual operating ratios for the two programs were almost identical. The ratio was slightly higher than the ratio for the Research Grants and Scholarships Directorate (4.2%) and slightly lower than the ratio for NSERC as a whole (4.9%) for the same time period. The operating ratio for the program trended downward until fiscal year 2009-10. Although it was outside the scope of the evaluation, as the figures were available, administrative costs for fiscal year 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 4.1% to 4.5%), which is still less than the nine-year average (4.6%).

Administrative costs include both the direct and indirect costs of administering the programs. Direct costs comprise salary[7] 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 Scholarships and Fellowships 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 IT) 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 USRA awards to total NSERC grant funds. It should be noted that the estimate of administrative costs only takes NSERC's expenditures into account. The amount spent by universities and industry on administering the awards is not reflected.

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[7] Salary estimates exclude employee benefits (EBP).

Table 12: Estimated costs for the USRA program

	2001-02	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-2009	2009-2010
Direct salary	$210,427	$258,367	$294,269	$331,947	$243,616	$247,549	$243,673	$292,422	$257,940
Direct non-salary	$33,753	$31,999	$26,337	$30,259	$20,737	$18,543	$25,100	$29,714	$37,902
Total direct costs	$244,180	$290,365	$320,607	$362,206	$264,353	$266,092	$268,773	$322,136	$295,842
Indirect costs	$470,894	$581,747	$618,951	$596,896	$553,173	$529,044	$486,454	$666,615	$470,851
Grants funds awarded	$12,531,743	$15,386,038	$18,876,328	$19,408,296	$19,288,875	$18,983,482	$19,035,057	$23,988,765	$18,579,024
Operating ratio									
Direct	1.9%	1.9%	1.7%	1.9%	1.4%	1.4%	1.4%	1.3%	1.6%
Indirect	3.8%	3.8%	3.3%	3.1%	2.9%	2.8%	2.6%	2.8%	2.5%
Operating Ratio	5.7%	5.7%	5.0%	4.9%	4.2%	4.2%	4.0%	4.1%	4.1%

Note: Total direct costs include non-salary and salary spending. Salary spending 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). Indirect costs, such as common administrative services for NSERC (e.g., finance, human resources and IT) were estimated using the ratio of total USRA awards to total NSERC grant funds.

Source: NSERC administrative data

There are a number of administrative steps that industry host organizations must undertake in order to participate in the USRA program (i.e., preparing an application for each USRA student, a Confirmation of Payments Form and a final report for each student). The cost associated with carrying out these steps is referred to as the *compliance cost*. According to survey results, industry host organizations spent an average of 12 hours of staff time on administration per award (the median was 8 hours). This equals about $750 per award holder on average (the median was $500) and represents 17% of the $4,500 reimbursement they receive from NSERC. Companies that had hosted four or more USRA holders reported a significantly lower average administrative cost per USRA holder (15 hours, $988) than companies that had hosted up to three award holders (9 hours; $534). Despite the costs, most industry supervisors (82%) said their organization was likely to participate in the USRA program again within the next two years, while 10% were unsure and only 8% were unlikely to participate.

Program Delivery

Liaison officers, university supervisors and industry supervisors were asked to reflect on how the USRA program, including its administration, could be improved. Overall, liaison officers expressed high regard for the way the program is being delivered, and described the guidance they receive from NSERC as consistent, timely and appropriate. A variety of practical concerns were raised, however, regarding the user-friendliness and functionality of the newly introduced online application system. The most frequently raised issue by liaison officers (7) was that the new system did not allow them to review students' applications to ensure that the correct information had been included. NSERC staff report that the online system has since been improved to address this issue.

Three liaison officers suggested that NSERC should change the timing of the award notification. Currently, NSERC does not officially confirm whether a student is approved for an award until

after the work term has already commenced. This poses a significant concern for institutions as the university must start paying the students before it receives NSERC's final decision in writing. One liaison officer explained:

> NSERC doesn't let us know until the student is into the award. We're taking a chance. We know they meet all the requirements, but it always feels funny that we're paying them, and unless we get the final word that the money will be there, we're always taking a chance.

These liaison officers suggested that the application process for the USRA program commence earlier in the school year so that students could be offered USRAs before they seek other job offers. This would also help students with their financial planning:

> We run our competition early here at [the university] and we do that because we want the students to know by the February reading break whether they have a summer job or not. So the only real issue is getting information [from NSERC] in order to [promote] the awards in September or October.

Promotional material about the USRA program, targeting both high school students and undergraduate students, was requested by seven interviewees. Some also suggested that NSERC should continue to actively promote the USRA program at universities to help boost the number of applicants, as well as faculty knowledge of the program. One liaison officer stated:

> One year, [the university] had [an NSERC representative] come and talk. She gave a good outline of the USRA program, and a lot of students attended, and a lot of them applied for USRAs that year. I think having more opportunities for having people come from NSERC and talk about the USRA (…) because it enhances what the faculty here can say about the award.

The interviews with liaison officers also provided some insight into how universities can promote the program and enhance students' USRA experience. One liaison officer explained that the university organizes an event that offers awardees an opportunity to share their experiences with others:

> Every January, our Graduate Studies office hosts a reception of students who've received a USRA or any Tri-Council award, including Ontario Graduate Scholarships. It's an informal event with hors d'oeuvres to congratulate the students. We have speeches by the Associate Provost of Grad Studies and the President of the University to congratulate them for being top students and being successful in the awards competitions, and there will also be a speaker who is a current recipient of a prestigious post-grad scholarship so they can talk about their experiences and how they've gotten to where they are today. It gives a chance for the USRA recipients to mingle, meet faculty, and talk with fellow students in the dept that they've been working in. Let's them see the opportunities available at [the university], encouraging them to stay at [the university].

Slightly less than half (46%) of university supervisors provided suggestions on how the USRA program or its administration could be improved. The two most common suggestions were to increase the university quotas (13%) or the value of the award (11%). One in ten (11%) also suggested that the eligibility rules for receiving a USRA be changed. There was no consistency in responses with respect to what kind of changes university supervisors wanted to see, with the exception of a few who suggested lowering the required GPA.

Industry supervisors most commonly suggested that the paperwork be simplified (10%) and that the application and reporting process be managed online (8%). Some respondents did not seem to be aware that the application process currently is managed online. One respondent asked for more comprehensive and structured information on how to complete the required paperwork:

> As a first-time applicant, we found the process confusing. More detailed step-by-step instructions would definitely help. As it has been a long time since our one and only application, we will likely need to climb this learning curve again. The process may be simple for NSERC staff, but from the outside looking in, it's not obvious what the steps are and how to follow them.

Other suggestions from industry supervisors included an increase in the reimbursement amount to host organizations (6%), relaxed student GPA eligibility requirements (4%), quicker processing times (3%), and a longer work term (2%). Representatives from industry organizations that had not hired URU holders were asked how they thought the USRA program could be improved to better meet their R&D and hiring needs. Their responses were similar to those from URU host organizations in that they wanted NSERC to extend the award period (up to eight months), increase the reimbursement amount and lower the eligibility criteria for students.

Conclusions: NSERC's administrative costs for delivering the USRA program are low (less than 5%) and the administration of the program appears to be efficient. Industry host organizations' compliance costs represent only 17% of the reimbursement they receive from NSERC. Liaison officers were generally satisfied with the operation of the program, including the guidance they receive from NSERC. Some wanted to see changes in the timing of the award notification, improvements to the newly launched online application system, more promotional material/activities, and researcher incentives for hiring Aboriginal USRA holders. Industry supervisors requested simplified paperwork and an online reporting process.

Alternative Delivery Approaches

The evaluation also explored whether there are other more effective or cost-effective means by which NSERC could stimulate student interest in R&D and motivate undergraduate students to undertake graduate studies and a career in the NSE.

When university and industry supervisors were asked in what other ways NSERC could motivate students to pursue graduate studies, almost the only answer was expanding the USRA program and increasing the value of the awards. The only non-USRA-related suggestion mentioned by more than 2% of university supervisors was for NSERC to organize events for undergraduate students, such as conferences or contests. Some liaison officers (4) also suggested that NSERC fund undergraduate students to go to conferences, which would provide them with networking opportunities.

> **Conclusions**: There do not appear to be alternative delivery approaches for NSERC that are more cost-efficient or effective in motivating undergraduate students to pursue graduate studies.

Researcher/University Top-ups

The evaluation looked at the extent to which it would be possible for universities to provide top-ups above the current minimum amount.

Almost all university supervisors paid students from their NSERC grants (91%), and some from other grants (21%). Only one in ten (8%) listed the university as a source for the top-up. Most university supervisors (74%) indicated that they had paid the last USRA students they supervised more than the minimum (Table 13). On average, they paid a top-up of $2,821, which is about $1,700 higher than the minimum required top-up. Half of the supervisors did, however, pay less than $500 above the minimum (the median was $1,600). Also, several (8) of the liaison officers interviewed indicated that the researchers at their universities generally only paid students close to the required minimum amount. The average top-up varied by discipline. Researchers in physical sciences paid the most (about $3,300 on average) while researchers in mathematics and statistics paid the least (about $2,300 on average). Researchers in the life sciences, engineering and computer science all paid an average top-up of approximately $2,700. Similarly, liaison officers explained that researchers with greater amounts of research funding, such as researchers in physical sciences and engineering, tended to pay higher top-ups, whereas other researchers with limited funding tended to pay less. Availability of funds was not, however, the only reason researchers in some disciplines pay higher top-ups. One liaison officer explained that engineering students are often able to find summer employment outside the university that pays higher wages than the USRA, and in order to "attract and retain those students," it is necessary for researchers to offer competitive pay.

A large majority of university supervisors (90%) said that they could provide a top-up higher than the minimum ($1,125) and still support the same number of students. The average maximum amount they could pay and still support the same number of students was close to what they already paid ($2,814), but the median was slightly higher ($2,000). The average top-up researchers could pay varied by discipline, consistent with their current top-up amounts.

Table 13: Top-ups from researchers' grants for 16 weeks

	Current top-up (n=828)	Maximum top-up (n=911)
Less than $1,125	2%	4%
$1,125	24%	6%
More than $1,125	74%	90%
Total	100%	100%
Average top-up	$2,821	$2,814
Median top-up	$1,600	$2,000

Note: A third of university supervisors did not respond to the questions

Source: University supervisor survey

The evaluation also looked at researchers' preferences with regard to award amounts and number of awards. University supervisors were presented with the following scenario: If the university's or supervisor's minimum required contribution remained at $1,125, would you prefer that NSERC offer more awards by reducing the value per award, offer fewer rewards by increasing the value per award, or not make any change to the value or number of awards. About two thirds (64%) of supervisors preferred the status quo, while two in ten (19%) preferred more awards, and only one in ten (10%) wanted fewer awards with a higher award level. The reason supervisors did not want to see the overall number of awards reduced was that this would give fewer students' exposure to R&D in an academic setting and reduce the number of students who would pursue graduate studies. Having fewer students would also decrease the supervisors' productivity.

Conclusions: University supervisors indicated that they could pay a higher top-up than the minimum amount, but no more than what they currently are paying USRA holders. If they had to pay more, they would have to hire fewer students. An increase in their top-up amount would affect their overall research budget as almost all researchers pay USRA holders from their own grants. Industry supervisors prefer that NSERC maintain the value of the award and the number of awards as is, rather than increasing the number of awards by reducing the award amount or increasing the value of the award by decreasing the number of awards.

Industry Host Organization Top-ups

The evaluation looked at how a decrease or increase in the NSERC reimbursement amount to industry host organizations would affect the number of URU holders.

More than half of industry host organizations (59%) would hire fewer undergraduates if the reimbursement amount decreased. The most common reasons organizations would hire fewer

undergraduate students were that the organization had a limited budget for hiring students or that the company was small.

More than half of industry host organizations (59%) also said they would hire more undergraduate students if the reimbursement amount was higher. On average, these organizations would require $6,679 per student, which is about $2,000 more than they currently receive. Two in ten (19%) would require a reimbursement of less than $6,000; three in ten (28%), $6,000; and three in ten (29%), more than $6,000, leaving a quarter (24%) undetermined. It is also worth noting that only one in ten respondents from organizations that had not participated in the USRA program (11%) indicated that their decision not to participate in the program was based on the low reimbursement amount from NSERC.

Conclusions: It would take a substantial increase in the reimbursement amount before a considerable portion of industry organizations would consider hiring more undergraduate students.

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3   CONCLUSIONS AND RECOMMENDATIONS

The conclusions and recommendations are presented below.

3.1 Conclusions

The USRA program is designed to contribute to the supply of HQP in Canada. The evaluation found that there is a continued need to maintain a supply of HQP in Canada and that it is important for industry to have access to graduates with a Master's degree. The USRA program makes a contribution towards increasing the supply of HQP with a Master's degree in that slightly more than one quarter (28%) of the awards influence undergraduate students' plans to stay in university longer. This means that in 2009, about 1,160 out of 4,141 awardees changed their educational plans in order to stay in university longer as a result of the program. Considering the relatively low proportion that changed their educational plans to stay in university longer, it is unlikely that the high proportion of USRA students who undertake graduate studies (85%) compared with the general population (28%) can be attributed to the USRA work term. Similarly, only two in five awards (39%) lead to an increased interest in R&D among awardees, while a similar proportion of awards (40%) contribute to maintaining an already existing interest. The most likely reason that the program only has an impact on a portion of the students' educational plans and interests is that the awards are given to students with high academic achievements and an already existing interest in research in the NSE. The universities' selection criteria and processes are generally designed to identify the best students. It is important to remember that while the experience does not increase a majority of students' interest in R&D, it does help to maintain their existing interest.

Contributing to the supply of HQP in Canada is not, however, just about increasing the *number* of HQP who undertake graduate studies. Both the S&T strategy and NSERC's Strategic Outcome related to HQP emphasize the importance of *developing* HQP to give them the capacity to contribute to the modern global economy. The evaluation findings suggest that the USRA program is effective in doing so. The program's success in this area explains why awardees, liaison officers, university supervisors and industry supervisors all expressed a strong need for the program.

The USRA program helps prepare undergraduate students for a research career. It also reinforces their interest in and motivation for pursuing graduate studies and a research career. The award gives them exposure to a research environment, in many cases for the first time in their life. In fact, the single most important thing USRA holders said they gained from their work term was a better understanding of research or lab work (46% responding to an open-ended question, which is very high). The experience added value to students' undergraduate training in that it helped many choose their graduate program (66%), major or courses within their program (57%), electives or thesis topic (53%). It also gave them a rare opportunity to connect with mentors (i.e., supervisors) early in their careers. The findings also suggest that it is worthwhile for NSERC to allow the same student hold multiple awards. Students with multiple awards experienced more benefits than students who only held one award.

It appears reasonable to conclude that the 16-week work term has contributed to at least half of awardees pursuing a *research* career in the NSE, but it is hard to establish the magnitude of the contribution. Students' career choices are influenced by a wide range of individual and contextual factors (postsecondary education, labour market conditions and opportunities presented to graduates, etc.). It would therefore have been challenging to establish attribution even if the evaluation design had included a student comparison group.

While it is not an intended outcome, the USRA program does also contribute to researchers' productivity and gives them an opportunity to recruit and assess students for graduate studies. Researchers from large universities placed as much importance on the USRA program as researchers from small universities. Similarly, the USRA program helps industry improve research productivity and recruit new employees.

The USRA program is efficient in that the administrative costs to deliver it are low (4.6% for fiscal years 2001-02 to 2010-11) and comparable to those of the Research Grants and Scholarships Directorate and NSERC as a whole. Industry host organizations estimate that their compliance costs represent roughly 17% of the reimbursement they receive from NSERC. Despite the costs, most industry supervisors (82%) said their organization was likely to participate in the USRA program again within the next two years. The evaluation did not identify any alternative delivery approaches for NSERC that appeared more cost-efficient or effective in preparing undergraduate students for a research career. There were, however, a number of other programs that used the same approach as the USRA program (i.e., provided funding for a work term). Although other programs exist, the USRA program is the only one that offers research opportunities to undergraduate students in all NSE disciplines, is national in scope, and offers the option of research experience in a university or industrial setting. The USRA program's unique position highlights the importance of the program to NSERC's mandate of supporting the next generation of scientists and engineers across Canada.

Liaison officers were generally satisfied with the operation of the program, including the guidance they received from NSERC. Some wanted to see changes in the timing of award notification, improvements to the newly launched online application system, and more promotional material or activities. Industry supervisors requested simplified paperwork and an online reporting process

The evaluation looked at what an appropriate award level might be and identified some policy implications of different financing options. Survey results showed that half of students and university supervisors think that the minimum value of the award should be higher, mainly to ensure that it is above minimum wage, but also to make the pay more competitive in relation to other job opportunities. The importance of ensuring that the value of the award is at least equivalent to minimum wage was underscored by the fact that the award represents almost two thirds of students' personal annual income on average. The level of pay that is required to attract students to a USRA varies based on factors such as research funding available, discipline, year of study, type of work, skill requirements and other individual circumstances. Consequently, NSERC should primarily be concerned with ensuring that the award level is

adequate for supporting students. Supervisors can, and do, provide top-ups higher than the minimum, depending on the context.

USRA holders, particularly those working for industry, are already paid more than the minimum value of the award ($4,500) on average. University supervisors also indicated that they could pay a higher top-up than the minimum amount, but no more than what they currently are paying USRA holders ($7,300 according to university supervisors and $6,600 according to URU holders, on average). If they had to pay more, they would have to hire fewer students. An increase in their top-up amount would affect their overall research budget, as almost all researchers pay USRA holders from their own grants. The evaluation also found that while university supervisors think that the award amount is important, they would not want to see NSERC reduce the current quotas to help pay for a higher award value. Researchers prefer that NSERC keep the value of the award and the number of awards the same rather than increasing the number of awards by reducing the award amount or increasing the value of the award by decreasing the number of awards. Industry host organizations would be less affected than researchers by an increase in the minimum award level as they already pay students substantially more than what is required ($9,300 on average according to URU holders). The findings also suggest that it would take a substantial increase in the reimbursement amount before a considerable portion of industry organizations would consider hiring more undergraduate students through the USRA program.

Overall, the performance data collected as part of the program's performance measurement strategy was sufficient to effectively support the evaluation, given that the USRA program is a low-risk program. The evaluation design, which used post-test only measures and secondary sources to help establish criteria for success, rather than baseline data and a comparison group, was sufficiently rigorous in that it provided for the evaluation to draw substantiated conclusions related to the program's performance. Future evaluations could benefit from an even stronger design if baseline data were collected for award holders and a comparison group was identified and surveyed. The benefits of a more rigorous design would, however, need to be assessed against the cost implications and the information needs of NSERC's senior management.

3.2 Recommendations

A few recommendations are presented below for consideration.

Recommendation #1: Continue offering Undergraduate Student Research Awards and make adjustments to the program's objectives and expected outcomes.

Undergraduate Student Research Awards have strong support from institutions, researchers, companies and students. The program is addressing an important need and continues to be relevant to Canada's priorities in R&D and S&T. It contributes to the supply of HQP, primarily by contributing to their development, and has an impact on award holders' interest in research and their career plans, albeit to a lesser extent. The program also improves researchers' and

companies' research productivity. As a result of these achievements, it is recommended that the program be continued.

The evaluation findings highlight the need to further refine the program objectives and expected outcomes to better articulate its contribution to the supply of HQP in Canada. According to the program description and logic model, the USRA's key objectives are to stimulate/increase students' interest in research in the NSE and to encourage them to undertake graduate studies. However, the program makes a greater contribution in terms of developing HQP (e.g., preparing them for a career in R&D), than it does in increasing the supply of HQP in Canada. For example, slightly more than one quarter (28%) of the awards influence undergraduate students' plans to stay in university longer and two in five awards (39%) lead to an increased interest in R&D among awardees; a similar proportion of awards (40%) contribute to maintaining an already existing interest. This is not surprising as the program is designed to provide awards to students with high academic achievements and an interest in R&D. To ensure that the program is not held accountable for an outcome that it only can affect to a limited extent, the evaluation recommends that the program objectives and expected outcomes be updated to reflect the fact that the program is at least as likely to reinforce awardees' existing interest and career path as to change it.

Recommendation #2: Consider making improvements to the design and delivery of the program.

In addition to assessing the program's performance, the evaluation looked at a number of design and delivery elements to meet the information needs of NSERC program management. The evaluation made a number of recommendations on how the program's design and delivery can be improved:

a) **Ensure higher remuneration for students.**

   It is important to raise the value of the award to ensure that students receive at least the equivalent of minimum wage, particularly since the award is an important source of income. Currently, some students receive less than minimum wage during their work term.

b) **Adjust the timing of the award notification for university (URU) awards.**

   An earlier award decision reduces the risk universities take in starting to pay students before receiving the award notification from NSERC. Also, if the awards were announced prior to the work term, NSERC would have an opportunity to collect baseline data from the students. NSERC should consult with liaison officers to determine the appropriate timing of the award notification.

c) Provide additional guidance to liaison officers on how NSERC expects universities to operationalize the selection criteria "aptitude for research".

NSERC asks that universities develop their own selection criteria within the broad guidelines it has established; namely the students' academic record and aptitude for research. The evaluation found that some universities relied on students' academic record alone (i.e., their cumulative average). If NSERC considers it important for all universities to take additional criteria into account in assessing applicants' aptitude for research, it should provide liaison officers with additional guidance on its expectations. To ensure that universities' selection criteria are in line with what is expected, NSERC could also start asking liaison officers to report on the selection criteria they use.

d) Adopt new strategies to promote the USRA program.

NSERC used to conduct site visits at universities, during which the USRA program was promoted. While these activities were valued by participating institutions, in an effort to reduce administrative expenditures, NSERC no longer promotes the program on-site. To help ensure that institutions' need for promotional support is met, NSERC should adopt new strategies to promote the program. Facilitating an exchange of best practices between universities is one possible option. Pamphlets targeting both high school and university students could further assist liaison officers in promoting the program. NSERC could also explore ways the program could be promoted using social media.

e) Carry out formal consultations with university liaison officers on the newly implemented online application system.

Some of the challenges liaison officers experienced while using the new online system appeared to be the result of a learning curve. However, there also appears to be room for improvement. Feedback from liaison officers could be collected in writing on an ongoing basis following application submissions.

f) Create an online reporting system for industry host organizations, as well as more comprehensive and structured information on how to complete the required paperwork.

At the end of the work term, industry host organizations are required to submit a final report in letter format for each student, commenting on results achieved, problems encountered, and the organization's experience with the USRA program. The open-ended reporting format does not generate comparable data elements that can be summarized in an aggregated format. An online reporting form that includes a combination of close-ended and open-ended questions would provide NSERC with useful and accessible performance information. The information collected could limit the need to survey host organizations as part of future evaluations. An online reporting process with more close-ended questions could also make the reporting process less onerous for industry supervisors. In fact, some industry supervisors surveyed requested that NSERC implement an online reporting system.

In addition, industry host organizations would also benefit from more comprehensive and structured information on how to complete the required paperwork. This type of information could be provided both through the online application system and the program literature. Industry host organizations could be consulted further to determine what specific changes they would like to see.

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