



# IMHA *Reports*

Outcomes of the *Catalyst*  
*Grant: Skin Diseases and*  
*Conditions* program funded  
by the Institute of  
Musculoskeletal Health and  
Arthritis of the Canadian  
Institutes of Health Research

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## Preface

This report, prepared for the Institute of Musculoskeletal Health and Arthritis (IMHA) by its Analysis and Evaluation Unit, describes the outcomes of research projects supported by the program Catalyst Grant: Skin Diseases and Conditions (SDC) launched in July 2007 and funded by the institute's Strategic Initiatives (SI) budget in 2008.

IMHA is the primary source of funding for Canadian health research across six research foci: arthritis, musculoskeletal (MSK) rehabilitation, bone, skeletal muscle, skin and oral health. Each of these areas is equally important and offers significant opportunities for advancement of research and knowledge translation. IMHA's vision is to sustain health and enhance quality of life by eradicating the pain, suffering, and disability caused by arthritis and other MSK, oral and skin conditions. Advances in understanding, preventing and treating diseases and conditions across all six research foci provide a formidable means of achieving this vision. IMHA's mission reflects that of the Canadian Institutes of Health Research (CIHR) - to excel, according to internationally accepted standards of scientific excellence, in the creation of new knowledge in all relevant areas, and to translate that new knowledge into improved health for Canadians, more effective health services and products, and a strengthened Canadian health care system<sup>1</sup>.

The Analysis & Evaluation Unit aims to help IMHA understand the impact of its targeted funding and programs, and to assist the Institute Advisory Board (IAB) in decision-making and the development of strategic initiatives via evidence-based approaches. IMHA has systematically collected data on funding trends within its mandate, and from time to time surveyed researchers funded by their programs. Both funding trends and data collected on research outcomes are analyzed and used to inform strategic directions and activities. Recognizing the potential value of such data to others, IMHA initiated a more comprehensive approach to its data collection, analyses and evaluation activities. Amongst new elements of the approach was a knowledge translation activity initiated in 2010 and entitled "IMHA Reports" entailing the generation of reports on outcomes of IMHA's programs and initiatives.

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<sup>1</sup> [Health Research Roadmap: Creating innovative research for better health and health care](#)

IMHA Reports are disseminated to IMHA's IAB as well as to a variety of interested stakeholders including senior management and staff at IMHA and CIHR, researchers, organizations, policymakers and others interested in knowledge translation and/or outcomes of projects funded in relevant health research areas. The reports may also be of interest to other funding agencies and evaluators interested in measuring the impact of similar research programs.

For more information about IMHA, visit the following website:

<http://www.cihr-irsc.gc.ca/e/13217.html>

## Executive Summary

- IMHA launched the Catalyst Grant: Skin Diseases and Conditions (SDC) program based on the recommendations of an IMHA-supported consultation workshop. The recommendations included building capacity in skin disease research and enhancing knowledge exchange.
- From the 17 applications to the SDC program, 6 excellent and highly rated biomedical (Pillar/Theme 1) research projects were funded for a period of one year.
- Together, the six funded research projects aimed to better understand, develop treatment for, and/or prevent a wide range of skin conditions ranging from skin cancer, skin diseases involving inflammation and viral infection, wound healing, and skin aging and hair loss.
- At time of survey, and in accordance with the program objectives, all NPIs reported that their projects were in new research directions in skin diseases and conditions rather than continuations of existing or ongoing projects.
- Significant knowledge creation activities were reported by the funded NPIs, including publication of a total of 15 peer-reviewed articles, and 2, 9, 17 book contributions, oral presentations, and conference posters, respectively, on skin diseases and conditions.
- The bibliometric analysis showed that funded NPIs were prolific in knowledge creation and highly cited in the years prior to the SDC grant application.
- Nine trainees participated in SDC-funded research and their contributions were considered crucial to the outcomes of the projects. It is expected that their training in the projects funded will contribute to increase research capacity in the area of skin diseases and conditions.



- At time of survey of outcomes, all NPIs reported either having received additional funding or an expectation of additional funding via recent applications to CIHR and/or other agencies. It is expected that the SDC program will have helped better position the teams for additional funding and sustained momentum in research activities of the funded projects.

- Other specific noteworthy outcomes of the SDC-supported projects to date include:

One research team developed a novel model of skin cancer that relies on a three dimensional environment comprising the principal elements of skin. This drew the attention of a private foundation that is providing a total of \$450,000 for a period of 3 years for the project.

The long-term expectation of one project is to increase the understanding of regulatory T cell biology in the skin, and to inform the development of novel treatments for sclerotic and inflammatory skin diseases and graft versus host disease.

One research team used the SDC funding to follow up a serendipitous but noteworthy finding in a cardiovascular model, leading to the discovery of a novel therapeutic target for treating a variety of skin pathologies (aging and hair loss), from which a patent was filed and in-licensed to a start-up biotechnology company.

One project involved the development of a novel and effective therapy to reduce scar formation and treat other abnormal wound healing conditions.

One team reported that the SDC support helped launch a collaborative and interdisciplinary research program aimed at improving understanding of the molecular determinants of shingles and identifying targets for the development of novel antiviral treatments for the disease.

- Overall, the findings of this evaluation indicate substantial progress in the projects seeded and catalyzed by the SDC program. Further, the number of outcomes associated with knowledge creation, training, networking/collaboration, and commercialization leveraged by the SDC support are substantial, particularly given the relatively small amounts and short duration of funding. The expectation is that with time and additional funding and project development, further progress with the potential to improve the dermatological health of Canadians will occur.

## **CHAPTER 1**    **Introduction**

This chapter describes the background and objectives of the Catalyst Grant: Skin Diseases and Conditions program and the research projects that received funding.

## **Background**

Of all the body's vital organs - brain, heart, lungs, liver, kidneys, etc - skin weighs the most and has the largest surface area. Unfurled and laid flat, the skin of an average-sized, human adult covers about two square meters - an area roughly equivalent to an oversized beach towel. Our skin not only protects us against the everyday assaults of the external world, from air and water-borne germs, to extreme heat and cold, to corrosive chemicals and ultraviolet radiation, but also endows us with exquisite sensitivity to touch and temperature.

Skin diseases and conditions affect everyone at some time during his or her life, with approximately 1% of the population being moderately or severely disfigured as a consequence. Skin disease can be disfiguring and painful and its treatment is extremely costly. Inflammatory skin disorders like ulcers, psoriasis (chronic scaly skin patches), atopic dermatitis (chronic itchy and scaly skin), acne (pimples with permanent scarring and disfigurement), vitiligo (loss of skin color) and alopecia areata (immune-mediated loss of hair) can have profound impact on patients' lives and impose substantial social and financial burden. Hospital care expenditures for skin and related diseases in 1998 cost Canadian taxpayers \$723 million. In addition, cutaneous diseases are responsible for nearly half of the occupational disease that results in insurance claims<sup>2</sup>. The need for coordinated development of skin disease research in Canada is therefore important. The number of skin researchers in Canada is low, thus retaining researchers and supporting skin-related research is a key step to boosting capacity in this broad field.

Through mechanisms that include broad consultations and workshops, IMHA gathers input from multi-sector stakeholders including researchers, partner organizations and consumers in specific health areas, to aid in the development of health research priorities. Amongst workshops in the area of skin health, one titled "Skin Priority Workshop", was held in Toronto, Ontario, in December 2004. Participants in the workshop included researchers, physicians, nurses, patients, industry, voluntary health organizations (VHOs), academia, and government representatives, representing a broad range of

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<sup>2</sup> [Catalyst Grant: Skin Diseases and Conditions](#)

diverse stakeholders coming together for the first time on such a scale to exchange ideas about the future of Canadian skin health research. The main objectives of the workshop were to “provide insights into current skin disease research in Canada, and determine the national priorities for skin disease research”.

After hearing presentations from five skin experts who dealt with current research gaps and priorities, the workshop participants worked together to establish an action plan for skin disease research in Canada. The workshop led to recommendations to “1) define the social, economic, and medical burden of skin disease, 2) implement strategies and mechanisms to build capacity in targeted areas, 3) establish partnerships and alliances, 4) establish a skin disease patient coalition, 5) enhance knowledge exchange, and 6) establish effective communication mechanisms for the (Canadian Skin Patient ) Alliance”.

### **IMHA’s Skin Diseases and Conditions program**

To help move the workshop's outcomes forward, IMHA crafted the Catalyst Grant: Skin Diseases and Conditions (SDC) opportunity, launching a Request for Applications (RFA) in July 2007 with a contribution of up to \$600,000 (the total amount allocated after peer review was \$531,883). The CIHR Catalyst Grant program provides “seed” money, generally short-term funding for a period of one year, to help researchers gain momentum in new research activities in their pursuit of more comprehensive funding opportunities (e.g. operating grants, team grants). Catalyst grant funds can be employed for pilot or feasibility studies aiming to generate preliminary data in new areas of investigation, as well as early development and planning of research teams.

The objectives<sup>3</sup> of the Catalyst Grant: Skin Diseases and Conditions included:

- Providing new or established investigators with funding to pursue new areas of investigation.
- The generation of preliminary observations, data or knowledge, or the facilitation of team formation, as a first step towards the pursuit of more comprehensive funding opportunities by researchers or teams of researchers

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<sup>3</sup> [Catalyst Grant: Skin Diseases and Conditions – Funding Decisions Notification](#)

- Providing the opportunity for a unique combination of individual researchers to develop as a team
- The mobilization of research communities to develop research agendas and/or action plans to advance research in specific priority areas.

The SDC program provided one-year grants of up to \$100,000 (the average amount of the awards was \$88,647) to successful applications (effective date of funding was October 8, 2008). Applicants were encouraged to address skin health research within the context of any one of IMHA's priorities:

- Tissue injury, repair, replacement
- Physical activity, mobility, and health
- Pain, disability, and chronic diseases

The program was also expected to provide an opportunity for the development of multidisciplinary, transdisciplinary, and/or international research teams, as well as the mobilization of research communities in priority areas including one or more of the following<sup>4</sup>:

- Studies on the mechanism of skin damage, pathophysiology, genes and environment interactions, of skin diseases and conditions such as acne, psoriasis, eczema, skin cancer (etc.).
- Development and/or evaluation of novel interventions on skin diseases and conditions such as ulcers/sores, burns, inflammation and infection (etc.), to enhance wound healing and skin repair and regeneration.
- Studies on prevention (e.g., ulcers), the risk factors, prevalence and incidence across the spectrum (age, geography, gender, etc), burden of illness and the overall impact of skin diseases and conditions on patient quality of life (including the psychosocial aspects).

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<sup>4</sup> [Catalyst Grant: Skin Diseases and Conditions – Funding Decisions Notification](#)

## Funded research projects

From 17 applications submitted, CIHR’s peer-review process identified the top six projects (see below table), which were highly rated and scored as excellent, and recommended budgets, which were subsequently approved.

Nominated Principal Investigator	Project Title	Funding Amount	Primary Theme
Dr. François Auger - <i>Université Laval</i>	Modèles d'étude nouveaux et polyvalents produits par génie tissulaire pour l'analyse des cancers de la peau	\$100,000	Biomedical
Dr. Jan Dutz - <i>University of British Columbia</i>	Manipulating regulatory T cells to control inflammatory skin disease	\$100,000	Biomedical
Dr. Douglas Fudge - <i>University of Guelph</i>	The biomechanics of skin blistering diseases: a cellular and biophysical approach	\$97,822	Biomedical
Dr. David Granville - <i>St. Paul's Hospital</i>	Granzyme B in hair follicle growth	\$99,927	Biomedical
Dr. David O'Gorman - <i>University of Western Ontario</i>	The role of Periostin in promoting epithelial-myofibroblast transition and avoidance of apoptosis in cutaneous wound healing	\$53,013	Biomedical
Dr. Angela Pearson - <i>INRS - (Québec, QC)</i>	Understanding the molecular determinants of shingles	\$81,121	Biomedical

Details of the funded Skin Diseases and Conditions research projects (awardees listed in alphabetical order).

## Were the funded projects new directions in skin research?

It would be expected that to qualify for “catalysis” (e.g., seeding), proposals would not be a continuation of a previously funded or ongoing research program, but rather new directions in research undertaken in the area of skin diseases and conditions. Although the relevancy and/or peer review process at CIHR/IMHA was expected to ensure that only new projects stated as being in new directions were funded, our evaluation data obtained at a later date confirmed that research activities were still concordant with those expectations and objectives.

## **CHAPTER 2**     **Results and Outcomes**

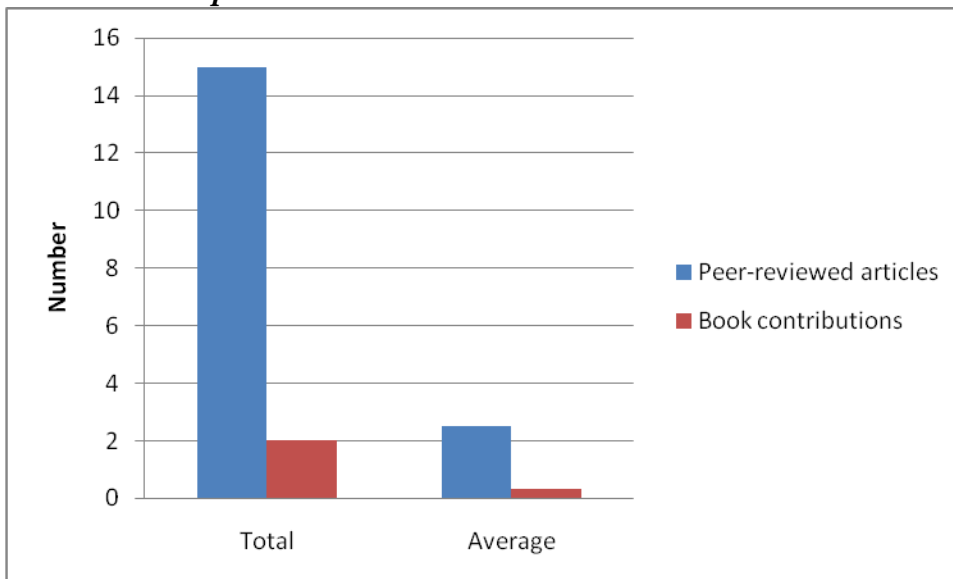
This chapter outlines the outcomes of research projects funded by the SDC program, as determined by summarized results from the MIS.



## Knowledge Creation and Dissemination

The survey findings show that skin research projects funded by the SDC program produced findings and new knowledge that were disseminated via publications, book contributions, posters, and oral presentations (see figures below). Each catalyst grant led to the publication of at least one peer-reviewed article. An average of 2.5 peer-reviewed publications resulted from each of the SDC-supported projects, with a total of 15 articles. Two NPIs authored at least one book contribution. There was an average of 1.5 and 2.8 oral presentations and conference posters resulting from the SDC-funded teams, with a total of 9 and 17 respectively.

### *Peer-reviewed publications and book contributions*

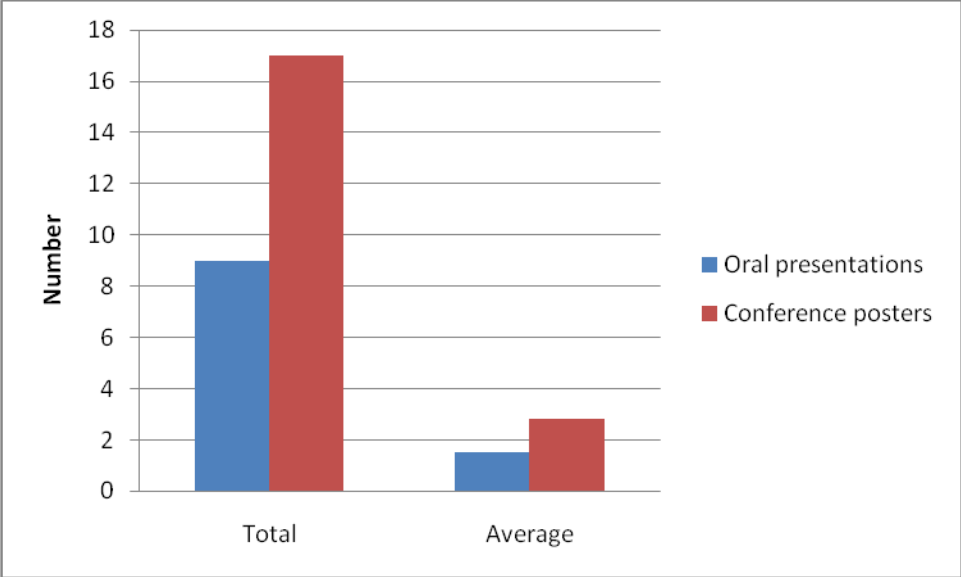


The total and average number of publications in peer-reviewed journals resulting (or expecting to result) from the SDC-supported projects as reported by the NPIs.

In addition to colleagues and other researchers, awardees reported disseminating their results to a diverse number of knowledge users, including the public, news media, and health professionals. It is not uncommon for biomedical researchers to disseminate their findings primarily to other scientists (e.g., via publications and conference activities) or other health professionals, with less dissemination to policymakers and patients as compared to health systems/services and social-cultural-environmental/population health

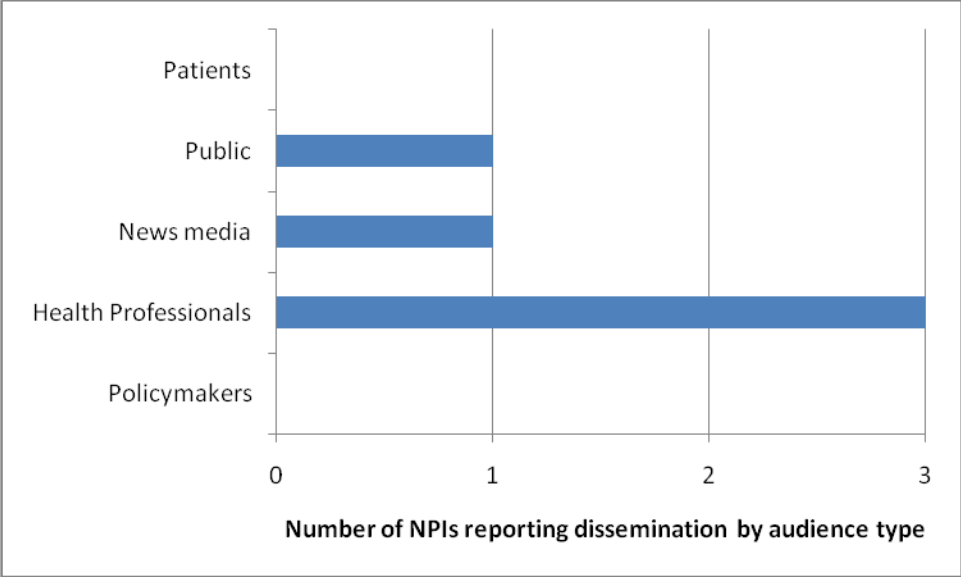
researchers<sup>5</sup>. Chapter 3 describes in greater detail some of the important contributions made to knowledge creation and translation by the research teams.

**Conference posters and oral presentations**



The total and average number of conference posters and oral presentations resulting (or expected to result) from the SDC-supported projects as reported by the NPIs.

**Dissemination of results**



The number of NPIs (of 6) reporting dissemination of results of projects to a specific population of knowledge users.

<sup>5</sup>In a recent evaluation of IMHA’s Seed Grant: Disparities and Oral Health program which funded health systems/services and social-cultural-environmental/population health research projects, more NPIs reported dissemination to policymakers and/or patients.

The numerous articles, book contributions, conference posters, and oral presentations resulting from the SDC-supported research have increased dissemination of new research knowledge related to skin diseases and conditions, and will continue to do so. These will be expected to contribute to informing future developments and advancements in this area.

## Bibliometric analysis

A bibliometric analysis of the funded and not funded applicants to the program was conducted to determine whether publication and citation records differed between the two groups. Analysis of the data revealed (see below table) that both the funded and not funded SDC applicants were prolific in knowledge creation (peer-reviewed and/or other published materials; see Methods) and that no significant differences between these two groups were observed on any of the bibliometric indices. Both groups had a similar number of years (e.g., range) over which articles were published, with an average of 19 and 20.1 years of publication by funded and not funded NPI groups, respectively.

Variable	Group	Avg.	Std. Error	Stat. Diff.	Sig.
Years of publication	Funded NPI group	19.0	2.3	No	0.79
	Not funded group	20.1	2.8		
Number of publications	Funded NPI group	49.2	13.9	No	0.87
	Not funded group	52.1	10.1		
Total citations of articles	Funded NPI group	1232.1	413.0	No	0.59
	Not funded group	1022.1	171.0		
Citations per year	Funded NPI group	59.2	19.7	No	0.47
	Not funded group	44.0	10.4		
h-index for articles	Funded NPI group	15.8	3.6	No	0.99
	Not funded group	15.8	2.1		
Number of publications (between 2003-2008)	Funded NPI group	20.5	5.3	No	0.87
	Not funded group	21.8	5.3		
Total citations of articles (pub. between 2003-2008)	Funded NPI group	335.5	106.0	No	0.71
	Not funded group	399.7	114.2		
Citations per year (pub. between 2003-2008)	Funded NPI group	37.8	11.6	No	0.71
	Not funded group	44.9	12.6		
h-index for articles (pub. between 2003-2008)	Funded NPI group	8.7	1.5	No	0.58
	Not funded group	10.3	2.0		

The bibliometric indices associated with applicants (i.e., NPIs) to the SDC program, grouped by application status: funded (N = 6) and not funded (N = 10) [Terms: Avg. = average; Std. Error = standard error of the mean; Stat. Diff. = statistical difference; Sig. = statistical significance reported as p-value. A number less than 0.05 indicates a significant difference between groups].

Both funded and not funded applicants to the SDC program have engaged in extensive knowledge creation and dissemination via peer-reviewed (and other) publication. The average career publications to date were 49.2 and 52.1 and average citations of articles were 1232.1 and 1022.1 (respectively), indicating high output of research findings as well as their high citation by the research community. The average h-index, a measure of researcher productivity and impact, was identical for both groups (15.8 and 15.8); this score indicates that on average 15.8 articles published by the NPIs were cited at least 15.8 times. In the years (2003-2008) leading up to the SDC effective year of funding, both groups contributed similarly and extensively to knowledge creation and dissemination (see table for more details), with no significant difference between funded and not funded NPIs.

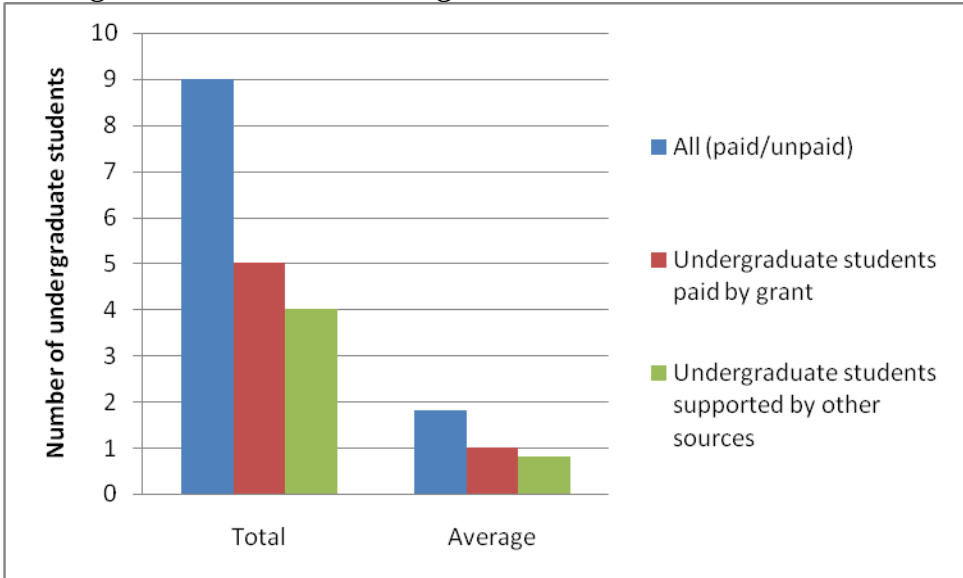
Applicants to the SDC program were prolific in their contributions to the scientific literature. No significant group differences were observed between the funded and not funded applicants to the program, indicating they were of equal caliber in knowledge creation as reflected in bibliometric measures.

### Training and employment

The survey results revealed that the research projects funded by the SDC program supported the training of many undergraduate and graduate students, as well as the employment or involvement of several research technicians (see figures below).

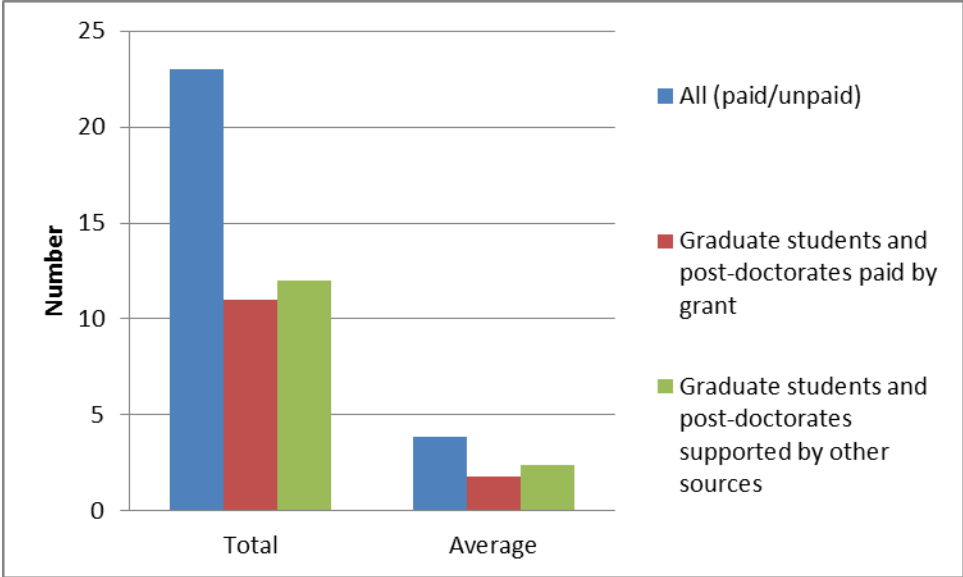
All the NPIs reported training at least one undergraduate student (paid by SDC grant or from other sources) on the skin-related research projects, an average of 1.8 per project and a total of 9 resulting from all projects supported by the SDC program. Similarly, all of the NPIs reported training at least one graduate student (Master’s, PhD, or Post-doctoral; paid by grant or from other sources), an average of 3.8 per project and a total of 22. The SDC grants supported a total of 10 technicians with an average of 1.7 per project.

#### Undergraduate student training



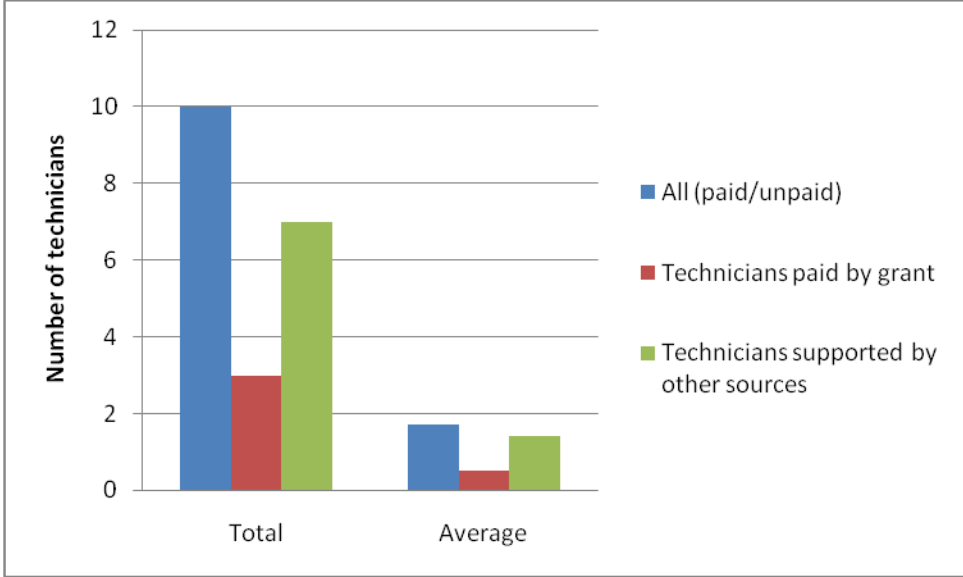
The number of undergraduate students trained on SDC-supported research as reported by the NPIs. Paid/unpaid means respectively paid from the SDC grant/paid from other sources.

**Graduate student and post-doctoral training**



The number of graduate students (Master’s, PhD) and post-doctorates trained on SDC-supported research as reported by the NPIs. Paid/unpaid means respectively paid from the SDC grant/paid from other sources.

**Technicians**



The number of technicians working on SDC-supported research projects as reported by the NPIs. Paid/unpaid means respectively paid from the SDC grant/paid from other sources.

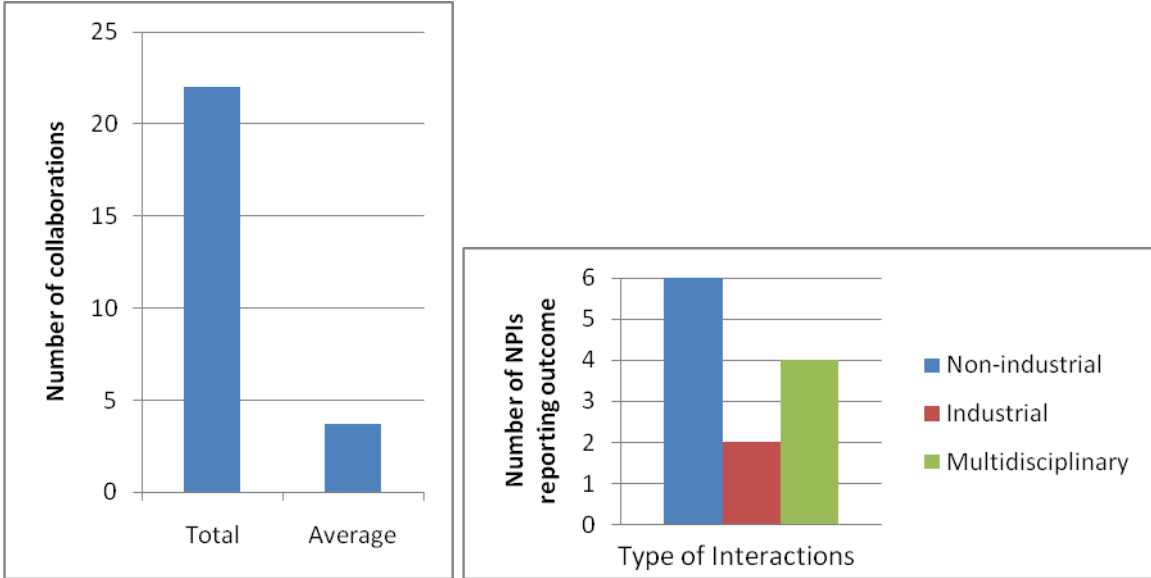
The training of a significant number of undergraduate and graduate students on the SDC-funded projects, and the support of many technicians, is expected to have the long-term impact of increasing researcher capacity in the area of skin diseases and conditions.



### New Collaborations

The MIS survey results revealed that skin research projects funded by the SDC program contributed to the development of many new researcher collaborations (i.e., with the NPIs). A total of 22 collaborations (excluding researchers who were co-applicants and co-PIs on the grant application) resulted from the six funded research projects, with all NPIs reporting at least one new collaboration, with an average of 3.7 per project.

#### Collaborations and research interactions



The number of new collaborations with other researchers, and the number of NPIs reporting a particular type of researcher interaction resulting (or expected to result) from the research projects supported by the SDC program.

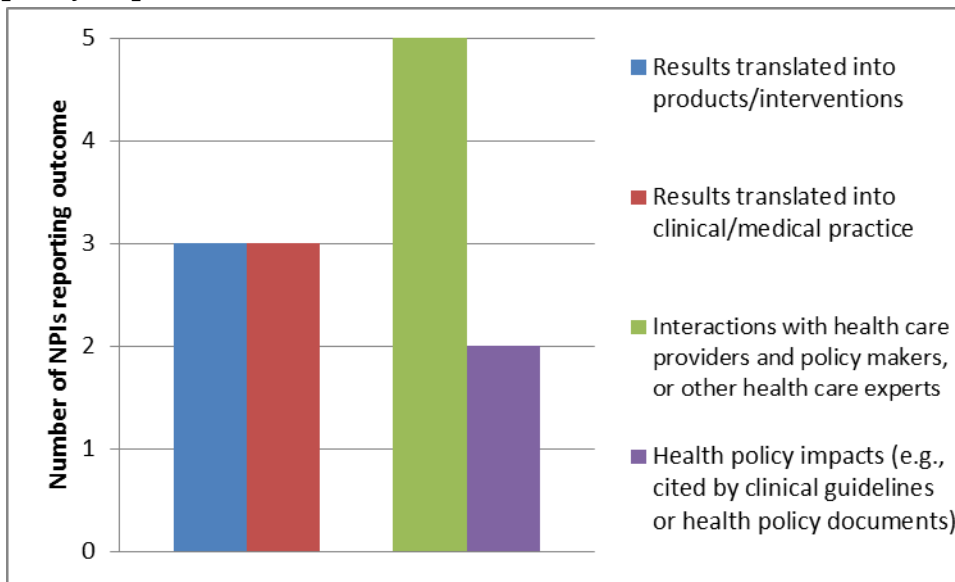
All NPIs reported interactions with non-industrial researchers, and two and four reported industrial and multidisciplinary interactions, respectively.

The large number of new collaborations (multidisciplinary) formed from the SDC-funded research projects shows that networking extended beyond those initially implicated in the grant applications, an indicator of increased capacity in skin diseases and conditions with the potential outcome of development of future projects related to skin diseases and conditions.

## Health Systems and Policy

The survey findings showed that the funded research projects produced numerous outcomes associated to some degree with health care products, health systems- or policy-level impact or potential such impacts (see figures below). Three of six SDC-supported NPIs reported that their results were translated (or expected to be translated) into new products or interventions (e.g., therapeutic pharmacological agents, stem cell therapy, gene therapy, diagnostic tests, or medical devices). Three of the NPIs reported that their research results were translated (or expected to be translated) into clinical areas (e.g., new clinical or medical tools, instruments, procedures, techniques, or diagnostics). All but one NPI reported interacting with health care experts/providers, and two reported that their findings are expected to impact health care policy (e.g., results cited by health care documents, policy, or guidelines). That only two NPIs reported health policy impacts is not surprising, as translation and application of biomedical research findings to that level is expected to take a longer time and often occurs via indirect effects.

### *Translation of results into health care products, health systems and health policy impacts*



The number of NPIs reporting that their SDC-supported research findings were (or were expected to be) translated into a health care- or health systems-related outcome, and the

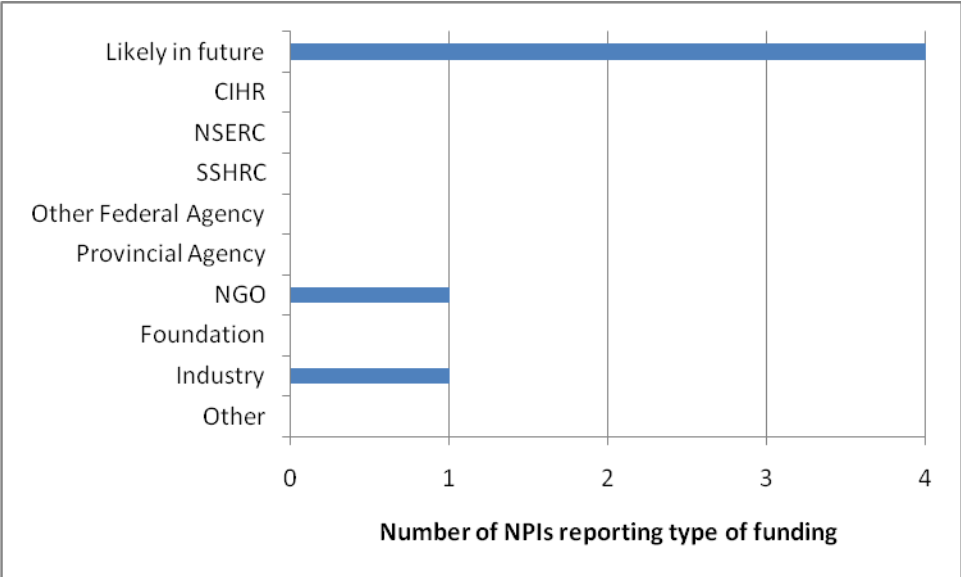
number reporting their research projects led to (or were expected to lead to) health policy impacts.

Although it is difficult to determine precisely health systems impacts given that the categories measured were broad and the timeframe after initial funding was relatively short, the overall findings suggest that the research teams were engaged in activities pertinent to the mobilization of health care/system-associated impacts, particularly in terms of product or intervention development with potential for translation into medical or clinical practice. Chapter 3 describes in greater detail how the research teams are planning to make (or are actively already making) important contributions to health research aimed at the treatment and/or prevention of skin-related diseases and conditions.

The evaluation results suggest that research projects funded by the SDC program have to date achieved an important number of outcomes associated with skin-related health systems and care. Despite the difficulty in evaluating the impact of biomedical research on health care or health systems, the above findings demonstrate the commitment of the researchers to making contributions beyond those associated with knowledge creation and publication.

### Funding Opportunities

All NPIs reported either additional funding enabled to some degree by the SDC grant or that additional funding was likely in the future (see figure below). Specifically, two funding awards were reported as resulting from the SDC research projects, with others likely in the future. Given that these survey outcomes were those reported relatively soon (i.e., approximately 1.5 years ) after receiving the SDC funding, that only a small number received additional funding at time of survey deployment was unsurprising.



The number of post-SDC funding awards received as reported by NPIs at time of survey.

As discussed in greater detail in Chapter 3, five grant applications are currently (at time of writing of this report) in process and each funded team is working on, or has already submitted, at least one application for funding, with at least four of those directed to a CIHR program.

These SDC outcomes are consistent with the objectives of most of CIHR’s Seed/Catalyst programs, which include the goal to better position grantees by enabling generation of preliminary findings to serve as a basis/foundation for subsequent grant applications.



## **Catalyst Grant 1: Modèles d'étude nouveaux et polyvalents produits par génie tissulaire pour l'analyse des cancers de la peau**

### ➤ *Unique skin cancer research model*

Skin cancers such as melanoma are considered among the worst dermatological conditions. Dr. Auger noted that the research funded by the SDC program increased his team's capacity to develop in vitro models of skin cancer with translational aspects for physiopathology and targeted therapies. Of interest, the model they developed goes beyond the traditional study of skin cancer with cellular cultures or animal models, and instead relies on a three dimensional environment comprising the principal elements of skin. This allows for unique studies of skin diseases and cancers, with many advantages over traditional animal or cultured cell research, and lacking many of their disadvantages.

### ➤ *Training in skin research*

The work of a student who obtained a PhD in 2010 from Université Laval was related to the SDC-funded project. As reported by Dr. Auger, the doctoral investigation led to a very interesting new research avenue with significant potential to improve tissue-engineered models for the study of melanoma metastatic mechanisms. The student is now working in a national research laboratory in France (Centre national de la recherche scientifique; CNRS) and has expressed the intention to work in a company that would involve, amongst other work, in vitro skin models.

### ➤ *Research project drawing large private foundation investment*

Of great significance, this SDC-funded research program drew the attention of a private foundation that is providing a total of \$450,000 for a period of 3 years to the team. This will have the impact of allowing the team to maintain momentum in their research activities.

### ➤ *Future developments and grant applications*

The long-term goal of the team is to break new ground in melanoma research and to identify pharmaceutical targets and treatments to lower the risk of primary melanoma tumors becoming metastatic. The new research direction previously described has led

to the initiation of a collaboration with an American scientist and dermatologists from Quebec City with clinical expertise to prepare an application for a CIHR operating grant for submission in September 2011. The grant would allow the team to focus on melanoma metastatic mechanisms based on tumour samples collected from patients.

## **Catalyst Grant 2: Manipulating regulatory T cells to control inflammatory skin disease**

### **➤ *Multidisciplinary collaboration in new research direction***

Dr. Dutz noted that Catalyst grants “promote productive collaborative work.” The SDC grant enabled the formation of a multidisciplinary collaboration between a seasoned investigator in regulatory T cell biology, a hematologist, and two dermatologists, and was a new direction for all the participants involved. The SDC funding enabled two non-skin investigators to pursue skin-related research, and provided Dr. Dutz (a dermatologist) the opportunity to engage in multidisciplinary research. The plan of the team is to continue collaborative work on skin-related research, including resident immune cells in graft versus host disease and other inflammatory skin diseases.

### **➤ *Research with potential to inform development of novel treatments for skin diseases***

The early research of this project examined the skin of patients with graft versus host disease, a debilitating complication of bone marrow transplantation, and investigated the expression of helper T cells important in the protection of the surface of skin against pathogens and implicated in skin inflammation. The long-term expectation of the SDC-supported project is to increase the understanding of regulatory T cell biology in the skin, which may eventually inform the development of novel treatments for sclerotic and inflammatory skin diseases, as well as graft versus host disease.

➤ ***Future developments and grant applications***

The preliminary data generated by the SDC project was used to inform the application for additional grants to explore regulatory T cell biology in the skin. The research team plans to apply (or have already applied) to different organizations, including CIHR and two others, for follow-up funding.

**Catalyst Grant 3: Granzyme B in hair follicle growth**

➤ ***Novel multidisciplinary research opportunity***

Funding from the SDC program allowed the Granville research team to follow up on a previous serendipitous but noteworthy finding in their cardiovascular model (the NPI is a cardiovascular researcher), in which they observed that diet and a particular protein might play a role in the onset and progression of skin aging and hair loss. The researchers also gained insight into gauging skin health as a means of assessing cardiovascular health. Specifically, this latter project arose unexpectedly after it was observed that mice with a predisposition to atherosclerosis exhibited accelerated skin aging and hair loss when fed a high fat diet. The project consequently gave the opportunity to a researcher with minimal dermatology expertise to establish an important and lasting multidisciplinary collaboration with two dermatologists to explore exciting findings in a different health research area. It was noted by Dr. Granville that “without the Catalyst grant it would have been difficult to pursue the dermatological work with such rigour”.

➤ ***Training in skin research***

As a result of early findings of the SDC-supported project, one student - who to date has won several awards - has been working full time in skin research and is a funded trainee of the UBC Skin Care Research program. A second graduate student is implicated in the biochemical and translational side of skin pathogenesis. Furthermore, one of the collaborators on the SDC-funded research project has enrolled a graduate student to follow up on separate findings that arose from the



collaboration pertaining to the link between alopecia areata and cardiovascular disease.

➤ ***Patent for hair loss and skin aging treatment***

The newly discovered insights into how diet affects hair loss and skin aging led to the discovery of a novel therapeutic target for treating a variety of skin pathologies. Specifically, the research received attention from industry for a particular protease (granzyme B) that might contribute to skin aging. A patent was filed and has been in-licensed from the university to a start-up biotechnology company named viDA Therapeutics Inc. Research at this company is currently underway to develop novel inhibitors of granzyme B as a potential treatment for certain age-related skin conditions. The role of granzymes in skin aging and pathology has since become a major focus of Dr. Granville's laboratory.

➤ ***Future developments and grant applications***

The recent research of the SDC-funded team revealed that granzyme B accumulates in the skin during aging and may negatively impact wound healing. As such, they are now investigating the role of granzyme B in non-healing skin ulcers in the elderly and disabled. Further, as reported by Dr. Granville, the enrollment of PhD student, Paul Hiebert, in the UBC Skin Research program has provided a tremendous boost to this research due to his expertise and the resulting collaborations. The team has recently applied for two subsequent CIHR grants related to granzyme B, skin aging and wound healing.

**Catalyst Grant 4: The role of periostin in promoting epithelial-myofibroblast transition and avoidance of apoptosis in cutaneous wound healing**

➤ ***New and innovative skin research directions to reduce scarring***

The SDC program provided seed funding for a new research direction in skin wound healing, promoting the assimilation of new skills and research in the O'Gorman laboratory. The research involved a novel and effective therapy to reduce scar formation and treat other abnormal wound healing conditions. Dr. O'Gorman

commented that even relatively small amounts of seed funding provided by the SDC program are crucial. He hoped that CIHR/IMHA would continue to invest in such programs to support new and innovative research directions.

➤ *Strengthening of two research programs*

The SDC funding made it possible for the new research program to run in parallel with ongoing studies of Dupuytren's disease in the laboratory. The researchers have already identified synergistic interactions between the two programs that have accelerated the research output in both. It is expected that the two programs will continue to be strengthened by their interactions in the future.

➤ *New multidisciplinary collaboration*

The findings from this research led to a possible international collaboration with wound healing and fibrosis researchers in Australia.

➤ *Future developments and grant applications*

The findings of the research project have also formed the basis of a current operating grant application to CIHR. Further, the research has led to an ongoing dialogue with a technology company that may be interested in supporting future research in this area.

## **Catalyst Grant 5: Understanding the molecular determinants of shingles**

➤ *New research program for shingles treatment*

Shingles is a painful and debilitating skin condition associated with the virus that causes chickenpox, varicella zoster virus (VZV). Although VZV vaccination strategies aimed at inhibiting chickenpox have reduced the incidence of this childhood disease, a similar vaccine against shingles, which strikes later in life, has proven less effective. The SDC grant helped the research team launch a new program aimed at improving the understanding of the molecular determinants of shingles and identifying targets for the development of novel treatments for the disease. Dr. Pearson commented that the Catalyst/Seed grants offered by CIHR/IMHA are

extremely useful tools to allow the development of new research topics, and hoped that such programs would continue to be offered in the future.

➤ ***Collaborative and interdisciplinary project***

Although this new research program is still under development in her laboratory, already the experience her research team has gained working with this virus has contributed to a collaborative, interdisciplinary project aimed at developing an innovative point-of-care diagnostics platform for human neurotropic herpesviruses including VZV.

➤ ***Antiviral treatment strategies for shingles***

A long-term goal of the project is that the improved understanding of the molecular determinants of shingles resulting from the research will lead to the development of new antiviral treatment strategies for shingles.

➤ ***Future developments and grant applications***

No additional funds have yet been sought to follow up on the main subject of the original seed grant, as collection of additional preliminary data is underway. A grant application is, however, in development to fund a project involving VZV (and other neurotropic herpesviruses) in the context of a new point-of-care diagnostic platform exploiting novel biosensors.

## CHAPTER 4 Conclusions

### **Novel research directions and increased highly qualified personnel in skin diseases and conditions**

As summarized in the previous chapter, the research projects supported by the SDC program have already produced important and novel outcomes in the area of skin diseases and conditions, ranging from knowledge creation and dissemination, training of highly qualified personnel, building of collaborations and multidisciplinary teams, commercialization activities, and applications for and success in acquiring additional funding. Many NPIs noted that the Catalyst and Seed grant programs are crucial for the support of new research directions and hoped they would continue to operate in the future. SDC- funded grants were unique in that emphasis was on exploration of new research ideas and directions, an outcome meeting the overall program objective. In contrast, NPIs engaged in skin research funded in a concurrent open competition (OGPA; bridge grants) and receiving similar funding amounts reported mainly projects that were continuations of ongoing projects.

The SDC program therefore served to identify and catalyze new and innovative directions in Canadian skin research aimed at treating and/or preventing numerous skin diseases and conditions, ranging from skin cancer to wound healing.

One objective of the SDC program was the facilitation of formation of expert teams and networking in the area of skin diseases and conditions. In total, the SDC funding supported the formation of 22 new collaborations with the NPIs, not including all the new interactions and collaborations possibly occurring between grant co-applicants/co-PIs and other researchers. A number of collaborations were multidisciplinary and/or international, and in some cases appeared to strengthen existing research programs running in parallel. Notably, some collaborators not involved in the initial grant application were impacted by the SDC-funded projects. For example, it was reported that one researcher expanded his/her training program to allow follow-up on findings resulting from collaborative work with an SDC-funded NPI. Also notable is that the collaborations and team building efforts resulting from the SDC grants in some cases changed or impacted other/non-SDC-

related applications to CIHR operating grants programs, as the new collaborations were felt to strengthen other applications or form the basis of new ones. Further, the new knowledge created by the SDC-funded research was translated into many peer-reviewed publications, with a total of 43 knowledge creation and dissemination items (including articles, book contributions, oral presentations, and conference posters) expected to result from the six projects evaluated.

The significant knowledge creation activities and collaborations resulting from the research projects supported by the SDC program are indicators of the important progress made to date in novel research directions in the areas of skin diseases and conditions.

Another salient outcome of the funded research projects was the training of many undergraduate and graduate students, and post-doctorates. Vice versa, trainees appeared to conduct work of high value as many of the project outcomes were attributable to trainee involvement. For example, one NPI reported that the enrollment of a PhD student with specialized expertise was crucial to the research direction, and other NPIs reported that the work of trainees led to new research avenues. Of interest, of those undergraduates who received a training stipend via a separate (non-SDC) IMHA summer research award) in the last 10 years and who responded to a recent survey we conducted, 65% reported they had continued or planned to continue into graduate research or professional training in an IMHA-related area. Consequently, a certain proportion of undergraduate students trained in and/or supported by a stipend on the SDC projects might be expected to continue their training at a graduate or professional level in the area of skin diseases and conditions.

The work of the trainees was considered as crucial to the many outcomes of the research projects. The high number of trainees working on the SDC projects is anticipated to increase research capacity in the area of skin diseases and conditions.

One of the objectives of Seed/Catalyst programs like the SDC is to position grantees for success in other/subsequent funding competitions. As discussed earlier, all the NPIs reported either receiving additional funding or expected to receive additional funding via

recent applications to CIHR and/or other agencies. One skin cancer research team reported an investment of \$450,000 from a private foundation. It will be important to follow-up with all of the projects to determine whether and how momentum was sustained in each case, as this was not possible to assess at the time of evaluation.

Overall, the findings presented in this report indicate substantial progress has been made in the projects seeded and catalyzed by the SDC program. With time and additional funding, and building on outcomes seeded by the program, further progress with the potential to improve the dermatological health of Canadians is expected to be made in the areas of skin aging and scarring, and skin diseases such as shingles and melanoma.

### **Lessons Learned**

There are also some “lessons learned” from the outcomes of the SDC program. One lesson is that Seed/Catalyst grants appear to meet their stated objective of facilitating research in new and novel directions. While this might be expected to occur given relevance review and peer review processes at CIHR that are meant to ensure that research proposals meet program objectives, the current report confirms that research *outcomes* (not just the proposals) were highly concordant with those objectives. Another lesson learned resides in the “indirect” impacts of funding of specific projects on other researchers or stakeholders (e.g., companies) that were not involved in the grant application but subsequently became involved in the funded research. For example, and as discussed in Chapter 3, the training program of one researcher who collaborated with an SDC-funded NPI was expanded, and a start-up company was given the opportunity to continue researching initial results of a SDC-funded project. These additional “indirect” impacts on collaborators or other stakeholders are outcomes that go beyond those traditionally evaluated, and warrant further exploration and greater emphasis in the evaluation of research grants.

In spite of relatively small research funds invested and their short duration, several “indirect” outcomes of the SDC program were identified. Improving the capture of such indirect effects of funding might be important from an evaluation perspective to widen the scope and better capture the full impacts of programs.

## **CHAPTER 5**    **Micro Impact Survey/Methods**

This chapter explains the methods and survey used to collect the data measuring outcomes of the six SDC grants.

## **Micro Impact Survey**

The MIS was developed to gather information pertaining to outcomes of research projects supported by IMHA's SI budget. It is a web-based survey instrument designated for the Nominated Principal Investigators (NPIs) or other leaders of the research project. The MIS was constructed and conducted online using kwiksurveys.com, a cost-effective and flexible survey creation website allowing responses to be collected and data to be exported in Excel format. The survey was designed to be suitable for assessment of any type of research grant funded by IMHA, and the question format allowed for both quantitative and qualitative input. Pilot testing confirmed the MIS was suitable for assessing outcomes of research projects from all of CIHR's research themes, i.e., biomedical (Theme I), clinical (II), health services/systems (III), and social-cultural-environmental/population health (IV) research areas.

The survey has 19 and 5 questions, requiring quantitative and qualitative input respectively, under the impact categories of (for actual survey, see Appendix):

- Advancing knowledge (e.g., publications)
- Capacity building (e.g., training, collaboration, team building)
- Knowledge exchange, synthesis and dissemination
- Health systems impact (e.g., health policy documentation, clinical guidelines)
- Economic impact (e.g., employment, patents, commercialization)

The MIS takes on average only 5-10 minutes to complete. Its low burden likely contributed to the high response rate. However, the brevity also means that the reportable outcomes are not as comprehensive or detailed as might be achieved with a longer and more extensive survey.

## **Methodology and analysis**

The first MIS e-mail survey invitations to SDC-supported NPIs were deployed in February 2010. Up to two additional reminder e-mails were sent to non-respondents, and the survey was closed in April 2010. All six SDC-supported NPIs (or other team leader) responded to the survey. In November/December 2010 e-mails were sent to the six NPIs requesting further details related to outcomes of their research projects; some of the NPIs



were contacted via telephone. In May 2011, NPIs (and/or other team leaders) reviewed their project section (in Chapter 3) and provided additional feedback and updates to ensure accuracy.

The MIS has two types of questions: those inquiring about number of contributions or “planned contributions”, and others inquiring about outcomes answerable by “Yes” or “No” or “No but likely in future”. NPIs therefore had the opportunity to report both “to date” and planned outcomes. The data summarized in this report are the combination of “to date” and planned outcomes of selected questions. An analysis of the entire MIS dataset, which includes data from outcomes of multiple programs comprising over 150 projects in the last 10 years, revealed no statistically significant difference between the total outcomes (“to date” + planned) of projects reported as “completed” (with little/no further planned outcomes reported) versus those reported as “ongoing” (with more planned outcomes reported). This finding suggests that the NPIs of more recent and ongoing research projects (such as the SDC) do not overestimate planned outcomes; thus, total outcomes (“to date” + planned) of recent projects measured by the MIS are likely a good estimate of eventual/actual outcomes.

The item-based outcomes (number of publications, collaborations, etc.) of all the SDC-supported projects were evaluated and analyzed in terms of the number of total contributions and the average outcome per project. Some data are reported in percentages of researchers reporting a particular outcome. For the purposes of this report data from questions 7 and 8 (see Appendix) were not analyzed because they assessed outcomes not highly relevant to the SDC program, such as commercialization-related questions which were largely left blank. Together, the remaining items allowed for the examination of the outcomes on team building and networking, collaborations, knowledge creation and dissemination, health care impacts, and funding opportunities provided.

It is also important to note that outcomes measured by the MIS are those associated with research projects often receiving additional funding from other grants or financial sources, thus do not necessarily reflect outcomes related only to the CIHR/IMHA funding

opportunity, but to those of broader research projects funded in part, if not mainly by CIHR/IMHA funding.

To help determine whether the SDC program had the impact of funding new research projects compared to those expected from a concurrent open competition, the former projects were compared to five skin health research projects funded (same amount and time period) via the program Operating Grant – Priority Announcement: Musculoskeletal Health, Arthritis, Skin, and Oral Health. The priority announcement program used CIHR’s open competition program where skin health researchers (or any IMHA-relevant) researchers can apply for funding for investigator-initiated research. By contrasting the skin projects funded by SDC to those of the OGPA program, one can therefore determine if the former program was successful at strategically funding research in new directions compared to those concurrently funded at non-strategic, researcher capacity level. The SDC program is expected to fund more grants engaged in development of new research directions compared to those funded by the OGPA, which typically serve as bridge funding for the continuation of previous projects.

### **Bibliometric analysis**

A bibliometric analysis of both the funded and not funded SDC NPIs was conducted with the free to use Publish or Perish software (PoP; [www.harzing.com/pop.htm](http://www.harzing.com/pop.htm)) and the freely accessible Google Scholar (GS; [scholar.google.com](http://scholar.google.com)). PoP interacts with GS, a web search engine that indexes the scholarly literature across different publishing formats and disciplines. It includes most peer-reviewed online journals and many other types of publications, including grey literature associated with a particular author. Sources include full-text journals, technical reports, theses, books, and other published documents. In this context, GS can provide a much broader view of researcher contributions to knowledge creation compared to other databases (Walters, 2007), including Scopus or Web of Science (Falagas, Pitsouni, Malietzis, & Pappas, 2008; Mikki, 2009). The bibliometric information generated by GS has also been found to correlate highly with those generated by Web of Science and Scopus (Bar-Ilan, Levene, & Lin, 2007). One disadvantage of GS due to its large database (e.g., journal articles and all items acquired via its web crawling algorithm) is that results may be “noisy” (Falagas et al., 2008; Mikki, 2009), containing

duplicates or otherwise unrelated or insignificant information (e.g., non-publication/knowledge creation items). As with any bibliometric database, a good screening procedure (see below) can help improve the results in terms of author specificity. Finally, GS includes items such as grey literature documents which may not impact certain citation scores (for example, due to lack of citations) but which nonetheless capture aggregate contributions of specific researchers/authors to knowledge creation.

The PoP software interfaces with GS and returns author-specific publications, as well as dozens of bibliometric indices, including total or article specific citations, Hirsch's h-index, Egghe's g-index, and more. The bibliometric data used in the current analysis to provide an index of the years of research experience were total career publications and range of years of publication. Additional indices providing a snapshot of the contributions to knowledge creation in the years leading up to the effective date of SDC funding were the number of publications, total citations of all articles, citations per article, and the h-index of items published between 2003-2008. The h-index is a measure of researcher productivity and impact; the score is based on a combination of the number of publications and the citations per article. A researcher with an index of h has published h papers each of which has been cited at least h times. For example, a score of 5 indicates that the author has published 5 articles, each one of which has been cited at least 5 times. Consequently, the h-index is not an indication of total publications, but rather an index of impact of publications.

The NPI names were individually run in the PoP "Author Impact" tab, using (including quotations) "Firstname Lastname". Middle initials were not included in the initial analysis, as they were not available for each NPI. The author-associated publication data outputted by PoP was screened and specific items omitted from analysis. The screening procedure was used to exclude non-publication items, errors, false positives (e.g., items not associated with author), and duplicates. Each publication item was individually screened to ensure author affiliation; for example, those with different initials or those articles not containing the NPI name as an author were omitted. To further reduce the number of false positives, the following unrelated research areas (as classified by GS) to

the SDC program were excluded from the search by unchecking “Business, Administration, Finance, Economics”, “Engineering, Computer Science, Mathematics”, and “Physics, Astronomy, Planetary Science”. Patents were also not included in the analysis as they are not knowledge creation items per se, or at least are a different form than the other items. The remaining items were used by PoP to generate the bibliometric indices. In the current analysis no anomalies were detected in that the items included appeared concordant with the area of research of specific authors, thus the occurrence of false positives was likely kept to a minimum. It is important to note that not all databases provide 100% accurate results; however, by applying the above methodology across all individual researchers, comparisons made between the SDC funded and not funded groups are possible. The group scores (funded versus not funded SDC applicants; N=6 and 10, respectively) were compared by using one-way analysis of variance (ANOVA) on each of the variables. Although the power of the statistical analysis is limited because the samples in the groups are small, the comparisons may help contextualize any differences between funded and not funded SDC applicants.

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## **Appendix: MIS Survey**

The survey used in this study is reproduced in its entirety below.

## Micro Impact Survey - Principal Investigator



CIHR IRSC

Institute of Musculoskeletal  
Health and Arthritis

**\*\*\*\*Important instructions/notes**

Your answers are to be based solely on the single grant referred to in the e-mail. While some of the measured outcomes may not fit with your project, please do your best to answer the questions.

Do not enter 0; leave blank instead.

TIP: when reporting outcomes related to publications or training, referring to an up to date CV will hasten the process.

\* 1.

Identification number provided in e-mail:

2.

The research funded by the grant is:

Completed

Ongoing

Not yet initiated (if so, please skip to end of survey and click "finish survey")

3.

Number of articles in peer-reviewed journals resulting from research funded by grant:

Accepted/published

Submitted

Planned for submission

4.

Number of technical reports resulting from research funded by grant:

Published

Planned for publication

5.

Number of conference proceedings (including those currently registered for) resulting from research funded by grant:

Posters

Oral presentations

6.

Number of published/in press (resulting from research funded by grant):

Books (main author or co-author)

Book chapters

Planned book contributions

7.

Number of patents resulting from research funded by grant:

Licensed

Granted

Applied for

Planned patent applications



8.

Number of copyrights resulting from research funded by grant:

Licensed

Granted

Applied for

Planned copyright applications

9.

Did receiving the grant significantly contribute to interactions with other researchers (non-industrial)?

Yes

No

No, but likely in future

10.

Did receiving the grant significantly contribute to interactions with researchers in industry?

Yes

No

No, but likely in future

11.

Did receiving the grant significantly contribute to interactions with health care providers and policy makers, or other health care experts?

Yes

No

No, but likely in future

12.

If answered "Yes" to question 9 or 10, were interactions made with researchers in a discipline different than your own?

Yes

No

13.

Did the grant contribute to the formation of new and lasting relationships with other researchers? If yes, please provide the number of such researchers that you have, are currently, or planning to collaborate with on other research projects unrelated to the grant (count each different researcher only once).

Already collaborated with

Currently collaborating with

Planning to collaborate with

14.

Did your research involve or lead to the development or trialling of interventions or products such as therapeutic pharmacological agents, stem cell therapy, gene therapy, diagnostic tests, or medical devices?

Yes

No

No, but likely in future

15.

Have any of the results directly impacted the health system via translation into clinical or medical practice (including new clinical or medical tools, instruments, procedures, techniques, or diagnostics)?

Yes

No

No, but likely in future

16.

The results from this grant have been disseminated to (via, but not restricted to, seminars, presentations, booklets, interviews) - click all that apply:

Policymakers

Health professionals

News media

Public

Patients

17.

Did your research results impact health policy (e.g., cited by clinical guidelines or health policy documents)?

Yes

No

No, but likely in future

18.

Number of trainees and personnel who received financial support (stipend/salary) from this grant:

Post-doctoral student  
PhD student  
Master's student  
Undergraduate student  
Research associate  
Technician/technical staff  
Other

19.

Number of trainees and personnel who worked on projects related to the grant despite not receiving financial support from grant:

Post-doctoral student  
PhD student  
Master's student  
Undergraduate student  
Research associate  
Technician/technical staff  
Other

20.

Did the funding from this grant enable you to acquire additional or other funding (click all that apply)?

Yes - from CIHR  
Yes - from NSERC  
Yes - from SSHRC  
Yes - from other federal agency  
Yes - from a provincial agency  
Yes - from an NGO  
Yes - from a foundation  
Yes - from industry  
Yes - from other funding source  
No  
No, but likely in future

21.

If there was funding from another organization that enabled the research results reported in the previous questions, was CIHR the major contributor?

Yes  
No

22.

How long has it taken you to complete the survey up to this point?

- less than 10 min
- less than 20 min
- less than 30 min
- less than 1 hour
- more than 1 hour
- more than 2 hours

OPEN-ENDED QUESTIONS (with large boxes provided for entry of text):

23.

(Optional - 1 of 5) Please comment on any other impact or success story that you think arose from this grant:

24.

(Optional - 2 of 5) What is your vision of the long-term impacts of your research?

25.

(Optional - 3 of 5) Describe your collaboration with other researchers and how these collaborations have impacted the capacity for research and the relevance of the research questions addressed:

26.

(Optional - 4 of 5) For clinical research, describe how the research project relates to needs of patients and communities:

27.

(Optional - 5 of 5) Please feel free to comment on your experience with CIHR or provide any type of feedback for CIHR or IMHA: