HEALTH SCIENCE INQUIRY

A publication platform for graduate students to discuss, discover, and inquire…

Volume 2 / Issue 1 / 2011

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HEALTH SCIENCE INQUIRY TEAM

Call for Submissions: Issue 3 (June 2012)

HEALTH SCIENCE INQUIRY

Issue #3
-Obesity and Diabetes-

June 2012

Health Science Inquiry will be publishing a new issue every year (June), and we welcome all Canadian graduate students to submit to us. We will be focusing on **Obesity and Diabetes** for our next issue, and although the full details are still being worked out, we will once again be partnering with a peer-reviewed journal and be implementing a similar competition for students.

In addition to these structured commentaries on various aspects of **Obesity and Diabetes**, we will also be accepting news articles and creative editorial pieces for the next issue of Health Science Inquiry. These submissions can focus on any topic within the health sciences, and serve to compliment the rest of the issue. If you're interested in writing a piece or have any questions about our next issue, visit our website (http://hsinquiry.sa.utoronto.ca) or email us (healthscienceinquiry@gmail.com)!

SPONSORSHIP

This year, HSI will be donating 50% of all sponsorship proceeds to a charitable donation in the area of cancer research. The charity that has been selected this year is the *Pediatric Oncology Group of Ontario:*

As the representative voice of the childhood cancer community, the Pediatric Oncology Group of Ontario (POGO) works to ensure that all of Ontario's children have equal access to state-of-the-art diagnosis, treatment and required ancillary services. POGO also aims to make certain that Ontario's children have the greatest prospects for survival with an optimal quality of life.

POGO
PEDIATRIC ONCOLOGY GROUP OF ONTARIO

COLLABORATING FOR KIDS WITH CANCER SINCE 1983

2011 Sponsors

Special Thanks

INTRODUCTION

FROM THE EDITOR-IN-CHIEF

Dear Readers

Welcome to the second issue of Health Science Inquiry! After a year of hard work, the 2010-2011 HSI Team is pleased to present a publication that continues to innovate and reflect a growing need for academic discourse amongst graduate students. Following a successful inaugural issue on H1N1, cancer was chosen as the theme of this year's issue. Though the journal was established and is currently based at the University of Toronto, we continue to procure the involvement of both students and faculty at a national level. With a team of over 40 graduate students spanning more than 10 Canadian universities, we have also expanded the journal to include two brand new sections – News Articles and Dialogue Pieces.

With News Articles, a team of dedicated News Reporters investigated various topics in cancer research, in addition to profiling some of Canada's most talented scientists. Through Dialogue Pieces, we invited two experts to write about controversial issues in cancer research (stem cell and animal-based research in cancer) and had members of Health Science Inquiry submit comments critiquing these opinionated pieces of work. To close off the discussion, each expert was given the opportunity to review these comments and submit a final response. Also new to this year's issue is a sponsorship section, where 50% of our annual proceeds will be donated to the *Pediatric Oncology Group of Ontario* (see Page 2).

Given that one of our 2010 submissions was selected for publication in a subsequent issue of *The Lancet Infectious Diseases* (see Page 7), we decided to once again partner with an international journal this year and are privileged to have the support of the *Canadian Medical Association Journal* (CMAJ). Being a Canada-wide publication, we could not think of a more appropriate and credible journal than the CMAJ and must thank Drs. John Fletcher (Deputy Editor) and Paul Hébert (Editor-in-Chief) for this invaluable opportunity. As a growing student-run organization, we are indebted to both the support and confidence bestowed by the CMAJ.

I hope you enjoy this issue as much as we have in planning and executing the pages of this publication!

Sincerely,

Wilson Kwong
Founding Editor-in-Chief

HEALTH SCIENCE INQUIRY – VOLUME 2

News Article

Section 1: News Articles

News Reporters from HSI's Editorial Team investigated various issues in cancer to present readers with insight into the latest research and initiatives across the country. Our team of reporters conducted interviews with key experts in a range of different topics.

Dialogue Piece

Section 2: Dialogue Pieces

Step 1

HSI invited 2 experts in the field of cancer research to write a 1000-word essay on a controversial topic that would generate discussion amongst our staff members and general readership. Jonathan Rusthoven has written an insightful piece on the use of embryonic stem cells in cancer research, while Nicholas Vesprini elaborates on his view of animal-based research in cancer.

Step 2

HSI Editorial Team members were asked to submit comments in response to each of the two Dialogue Pieces. Responses were aimed to question and challenge the originating authors' viewpoints in a respectful manner.

Step 3

Each original author was asked to submit a 500-word response to the comments written by the HSI Editorial Team.

Main Submission

Section 3: Main Submissions

Call for Submissions

Back in November of 2010, graduate students from all across Canada were asked to submit commentaries on various aspects of cancer. The commentaries were 700-800 words in length (maximum of 15 references) and focused on one of three specified topics of interest:

- *Treating and Pursuing a Cure for Cancer*
- *Prevention of Cancer*
- *Life After Cancer*

Review / Revisions

Starting in late March, each submission was reviewed by 2 different Reviewers from HSI. Reviewers provided feedback to the authors by critically assessing the content and writing of each commentary. After receiving comments from Reviewers, authors were given 2 weeks to revise their submission and resubmit their manuscript to the journal. A team of Senior Editors was then given the task of going through each commentary and providing final comments to the authors.

Judging Process

Faculty members from Canadian universities (see Page 5) were recruited as advisors, playing an instrumental role in the judging process of the journal. For each of the above three categories, 3-4 faculty advisors were assigned to rank each of the submissions in order of preference. A score was then assigned to each paper depending on how it was collectively ranked by all faculty members:

Example: Rank #1: Paper 1C = 5 Points
Rank #2: Paper 1A = 4 Points
Rank #3: Paper 1D = 3 Points
Rank #4: Paper 1B = 2 Points

TIMELINE

Submission

[December to March]

Students submitted **600-700 word** commentaries (max 15 references) on one of 3 areas pertaining cancer.

Review/Editing

[March to May]

An editing team commented on the writing and content of each submission, giving students a chance to revise their submissions.

Faculty Judging

[Late May to June]

Faculty members judged the submissions and selected the top paper from each of the 3 categories.

Prize Winners

[Early June]

Authors of each of the 3 top papers were rewarded by CMAJ Medical knowledge that matters

Publication

[Mid June]

All the submissions were published online and in a distributable pdf format.

Main Submission

Winners

After processing the rankings from all our faculty advisors, a combined score was tabulated for each submission. The authors of the highest scoring paper for each category received a free 1-year subscription to The Canadian Medical Association Journal. In addition, one of the papers was granted expedited review for possible publication in The Canadian Medical Association Journal.

The quality and creativeness of all the submissions were outstanding, and both the editorial team and faculty advisors highly commend the authors for their achievement and hard work! After tabulating the results, we are pleased to announce the winning submissions for the 2011 issue of Health Science Inquiry. Each of the authors have received a free 1-year subscription to The Canadian Medical Association Journal, and one submission will be granted expedited review and possibly publication in a subsequent issue of the journal.

Treating and Pursuing a Cure for Cancer

Waqas Ullah Khan and Diane Blonski **(Page 46)**

The Global Disparity Surrounding Cancer Treatment: How Can the Gap Be Closed?

Prevention of Cancer

Lindsay Kobayashi **(Page 52)**

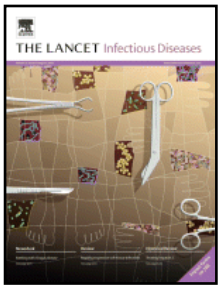
The Future of Primary Cancer Prevention in Canada: Reaching for Every Ounce of Prevention Means Reaching for Equity

Life After Cancer

Timothy Buckland **(Page 68)**

A Young Adult Cancer Survivor's Perspective on Life After Cancer

Last Year's WINNER



Chelsea Himsworth's paper was published as a 'Reflection and Reaction' piece in a 2010 issue of THE LANCET Infectious Diseases

http://www.thelancet.com/journals/laninf/article/PIIS1473-3099%2810%2970148-1/fulltext

We are very fortunate to have the involvement of 11 distinguished faculty members from all across Canada for this issue of Health Science Inquiry. Each faculty advisor was assigned to one of the three categories students were asked to write commentaries on, and their main responsibilities were to judge and comment on the submissions within each category.

Mayi Arcellana-Panlilio, PhD

University of Calgary

Mayi Arcellana-Panlilio has a PhD in Biochemistry and Molecular Biology (University of Calgary) and after a 3-year stint with a biotechnology firm, returned to academia to engage in pediatric cancer research. She was instrumental with establishing microarrays as a research tool at the University of Calgary and managing the Southern Alberta Microarray Facility for 10 years. She has been involved with teaching and mentoring in the Bachelor of Health Sciences program from the beginning, primarily to develop and deliver the Honours Cell & Molecular Biology course (a core requirement in the curriculum). She has taught every offering of that course and has received numerous accolades from both Faculty and students, most recently winning the Teaching Excellence Award for 2010-2011 from the University of Calgary Students Union. Mayi believes in the value of inquiry as a means to getting students engaged in their own learning, and in developing habits of becoming lifelong learners.

Michelle Arnot, PhD

University of Toronto

Dr. Michelle Arnot received a B.Sc. in Life Sciences at Queens University in Kingston, Ontario. Her PhD research was conducted at the University of Alberta in Neuropharmacology with Drs. Ian Martin and Alan Bateson, examining the modulation of ion channels following long term drug exposure. After completion of her graduate studies she worked for an educational outreach group in Calgary, Alberta developing educational programs for teachers. Michelle's postdoctoral research focused on ion channels and the regulation of neuronal excitability at the University of Calgary with Dr. Gerald Zamponi and at George Washington University in Washington DC with Dr. Tim Hales. She held a faculty position at the University of Maryland (College Park) teaching Cell Biology and Physiology. Michelle joined the Department of Pharmacology and Toxicology at the University of Toronto in 2007 where she is currently the Undergraduate Education Coordinator. She continues to conduct research on the modulation of ion channels in both the brain and the heart; however, her main focus at U of T is teaching, challenging her students and sharing her enthusiasm for pharmacology in a variety of undergraduate courses.

Carol Cass, PhD, FRSC, FCAHS

University of Alberta

Dr. Carol Cass is Scientific Director Research, Alberta Health Services - Cancer Care and Professor Emeritus Oncology and Adjunct Professor Biochemistry at the University of Aberta. Dr. Cass is former Director of the Cross Cancer Institute (2003-2010), Vice-President of the Alberta Cancer Board (2003-2008), Associate Director Research of the Cross Cancer Institute (1996-2003) and Chair of the Department of Oncology at the University of Alberta (1996-2007). Dr. Cass has played a national leadership role in Canadian research, including being a founding member of the Institute Advisory Board of the Institute of Cancer Research of the Canadian Institutes of Health Research, Chair of the Advisory Committee on Research of the National Cancer Institute of Canada, and member of the Medical Advisory Board of the Gairdner Foundation; she is currently a member of the Selection Committee of the Canadian Medical Hall of Fame and the Executive Committee of the Terry Fox Research Institute. A former Canada Research Chair in Oncology (2001-2008) and Terry Fox Cancer Research Scientist of the National Cancer Institute of Canada (1993-1999), Dr. Cass maintains an active discovery and translational research program in experimental cancer therapeutics at the Cross Cancer Institute. She is a Fellow of the Royal Society of Canada and of the Canadian Academy of Health Sciences and recipient of the 2006 Robert L. Noble Research Prize of the National Cancer Institute of Canada and the 2008 J. Gordin Kaplan Award for Excellent in Research of the University of Alberta.

Winson Cheung, MD, MPH, FRCPC

University of British Columbia

Dr. Winson Y. Cheung is a medical oncologist at the British Columbia Cancer Agency - Vancouver Centre Clinic and specializes in the treatment of head & neck as well as gastrointestinal malignancies. He is the recipient of numerous accolades, including the National Cancer Institute of Canada Dorothy Lamont Award, the Novartis Oncology Canadian Investigator Award, the Multinational Association of Supportive Care in Cancer Investigator Award, and several American Society of Clinical Oncology Merit Awards. His primary research interest is health services and outcomes research with the aim to ensure appropriate access to cancer care and enhance delivery of cancer therapies to all patients. He works closely with large administrative datasets to answer a wide spectrum of relevant clinical research questions. Most recently, he conducted analyses which revealed that expectations for follow-up care between cancer survivors and their physicians were discordant and how this discrepancy may pose a negative impact on patient outcomes.

Anthony Fields, MD, FRCPC

University of Alberta

Dr. Tony Fields is Vice President, Cancer Care, Alberta Health Services and Professor, Department of Oncology and Department of Medicine, University of Alberta. Dr. Fields attended school in his native Barbados, studied natural sciences at the University of Cambridge, and is a medical graduate of the University of Alberta. He trained in internal medicine and medical oncology at St. Michael's Hospital and the Princess Margaret Hospital respectively, in the University of Toronto system. He has been in academic practice in Edmonton since 1980. His clinical practice is at the Cross Cancer Institute in gastrointestinal oncology. He has held various administrative positions within the former Alberta Cancer Board, including Director of the Cross Cancer Institute and Vice President, Medical Affairs & Community Oncology. At the University of Alberta, he was previously Director of the interdepartmental Division of Oncology, and at the inception of the Department of Oncology he served as its Acting Chair.

Alan Katz, MBChB, MSc, CCFP

University of Manitoba

Alan Katz received his undergraduate and medical education at the University of Cape Town in South Africa. He did postgraduate training at the University of Manitoba. He is the Research director at the Department of Family Medicine and Associate director for Research at the Manitoba Centre for health Policy both at the University of Manitoba. His research interests include primary care oncology, quality of care and prevention in primary care as well the use of administrative claims data for primary care research.

Ralph Meyer, MD, FRCPC

Queen's University

Dr. Meyer assumed the role of Director, NCIC CTG in April, 2007. He holds the Edith and Carla Eisenhauer Chair in Clinical Cancer Research and is Professor in the Departments of Oncology, Medicine and Community Health and Epidemiology at Queen's University. As Director of the NCIC CTG, Dr. Meyer has responsibilities for ensuring the quality of its scientific agenda and operational processes and also takes an active part in the development, execution and analysis of many of the Group's trials. His own research interests are in the hematologic malignancies and in the generation of clinical trials evidence for use in health care policies. Dr. Meyer was previously based at McMaster University from 1984 – 2006 where he was Director of Division of Hematology and Professor in the Department of Medicine, and Head, Hematology Malignancy Program at the Juravinski Cancer Centre. He has been a previous chair of the NCIC CTG's Hematology Disease Site Committee.

Daniel Rayson, MD, FRCPC, FACP

Dalhousie University

Dr. Daniel Rayson is a Medical Oncologist at the Queen Elizabeth II Health Sciences Centre, as well as Professor of Medicine and Pediatrics at Dalhousie University. He completed his medical training at Dalhousie University and went on to specialize in Internal Medicine and Hematology/Medical Oncology at the Mayo Clinic in Rochester, Minnesota. His main areas of clinical care and research are in breast and gastrointestinal neuroendocrine oncology, with major areas of interest in cancer genetics, clinical trial development, as well as health services and translational research. He is past Chair of the Nova Scotia Provincial Breast Cancer Site Team (2000-2009) and the Clinical Trial Grant Panel Review Committee of the National Cancer Institute of Canada (2006-2009). In February 2008, he was appointed as Director of the Atlantic Clinical Cancer Research Unit (ACCRU) at the Queen Elizabeth II Health Sciences Centre and is a founding board member of the Beatrice Hunter Cancer Research Institute (BHCRI).

Hsien Yeow, B.Sc., PhD

McMaster University

Hsien Seow holds McMaster's Cancer Care Ontario Research Chair in Health Services Research in the Department of Oncology. His PhD is from Johns Hopkins School of Public Health, Department of Health Policy and Management, with a concentration in health services research and a certificate in Gerontology. His research interests involve examining ways to better coordinate, organize and deliver healthcare services and improve quality for those with serious, chronic illness. He has worked with RAND Health in Washington DC, where he led health policy research, quality improvement, and health advocacy initiatives. He earned a B.Sc. from Yale University.

Tallal Younis, MBBCh, FRCP (UK)

Dalhousie University

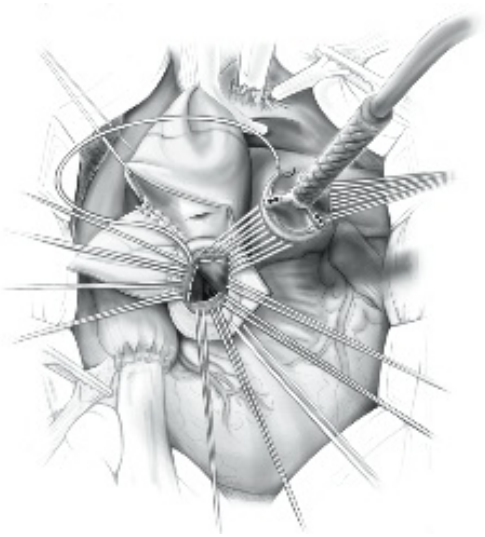
Dr. Younis received his medical degree from Cairo University in 1992. He completed an internal medicine residency in 2001 at Columbia University, New York, and a Medical Oncology Fellowship in 2003 at the Roswell Park Cancer Institute, State University of New York at Buffalo. Dr. Younis is currently a medical oncologist at the Queen Elizabeth II Health Sciences Centre in Halifax, and a co-chair of the Nova Scotia provincial breast site team. He is an associate professor of Medicine and a clinical research scholar at Dalhousie University. His research interests involve health economics and health services research in breast cancer.

This year, we've collaborated with numerous Canadian graduate students to form an *Artistic Images* section. The following pieces are visual representations of healthcare and the medical sciences:

Stefania Spano

Stefania Spano is an Honours graduate of the Neuroscience and English programs at the University of Toronto (HBSc, 2010). Unwilling to part with the University, Stefania currently remains there as a Master of Science candidate in Biomedical Communications (Institute of Medical Science, MScBMC, 2012). Ms. Spano is a lifelong fan of both the arts and science, with a focus on producing clear, accurate and aesthetic biomedical art. When she is not doodling, Stefania busies herself with books, music, theatre, New Scientist magazine and copious amounts of chocolate. This is Ms. Spano's first appearance in the Health Science Inquiry.

Aortic Valve Replacement & Aortic Root Enlargement: Primary Incisions: During an aortic valve replacement and aortic root enlargement, the aorta is incised below a cross-clamp, first in the transverse axis on the anterior aorta, then turning sharply down the posterior aorta in a craniocaudal direction.



Aortic Valve Replacement & Aortic Root Enlargement: Bioprosthesis Placement: During an aortic valve replacement and aortic root enlargement, a bioprosthetic patch is sutured to part of the aorta to widen its root. A bioprosthetic valve is then sutured to the annulus of the aorta in a circular pattern and slowly lowered into place, replacing the excised pathological leaflets of the endogenous aortic valve.

Lyndsay Stephenson

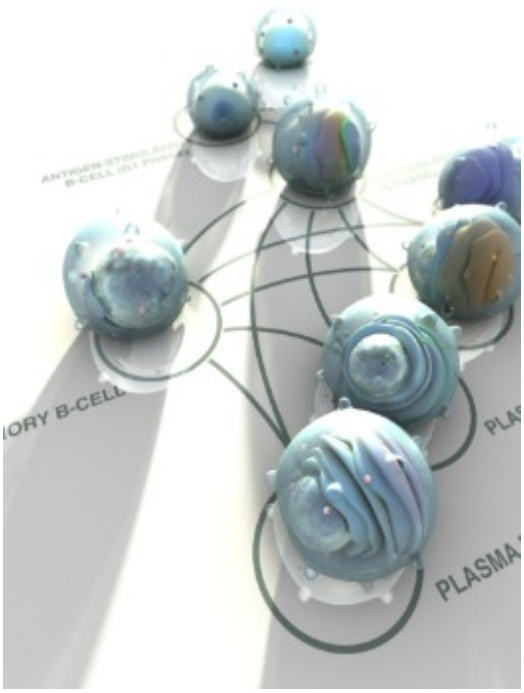
With an Honours B.Sc. in Biological Sciences and a lifelong love of art, Lyndsay Stephenson is currently bridging the gap between these two fields by studying in the Master of Science in Biomedical Communications program at the University of Toronto. A member of the Association of Medical Illustrators, Lyndsay hopes to pursue a career in designing interactive visual media to help communicate scientific and medical content to a range of audiences, from school children to medical students to patients in the healthcare system ... and anyone in between! She is particularly excited about her current project of designing a unique iPad App for patient education in one of Toronto's most renowned hospitals!

Care: An elderly woman being tucked into bed in good health.

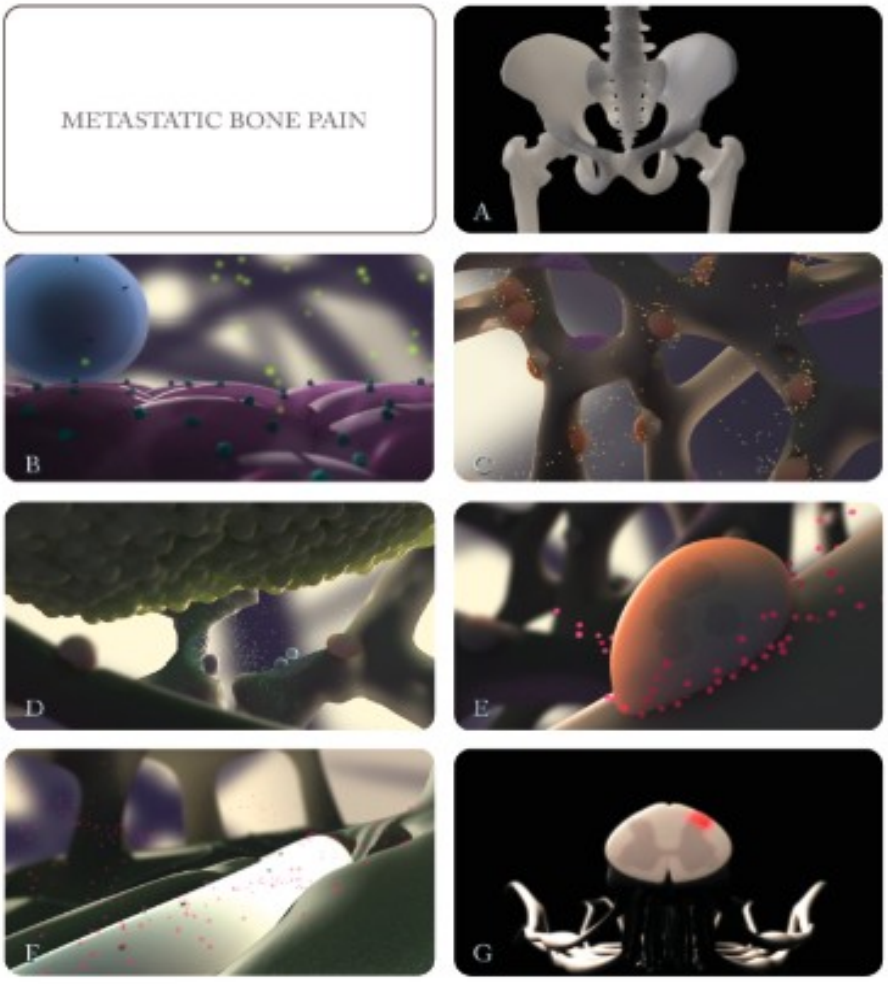
Hope: The winter sun shining through a bud encased in ice as it waits for the spring.

Geoffrey L. Cheung

Geoffrey is a recent graduate from the Biomedical Communications program at the University of Toronto where the focus of his studies was 3D technologies and educational gaming. Previously, as Geoffrey worked towards his Bachelors in Life Science, he found that he was always looking for opportunities to be involved in the visual arts. Biomedical Communications was the opportunity that he was looking for, as it allowed him to combine his passion for these two disciplines. In this field, Geoffrey saw the ability to help improve the quality of education and the deliverance of knowledge, and ultimately, the potential to help further advance our collective knowledge of science.
www.glcheung.com



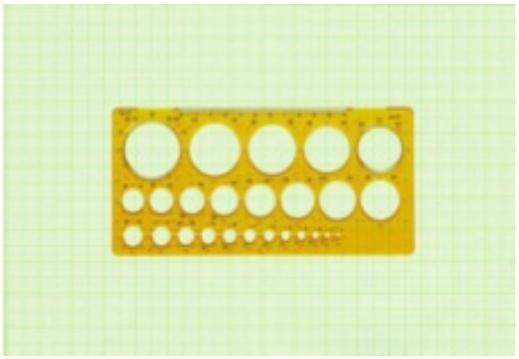
Cell Line: This editorial illustration is a quick glimpse of the B-cell differentiation tree.

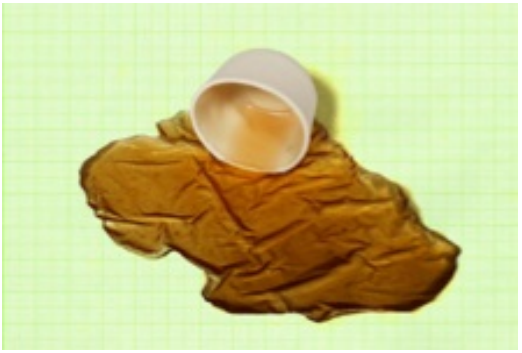


Metastatic Bone Pain: These stills depict the pathophysiological onset of peripheral pain in patients suffering from metastatic bone cancer. (A) Long bone, such as the femur, is the most common site of metastatic growth. (B) The tumour alters osteoblast (purple) and monocyte (blue) function, leading to (C) increased osteoclastogenesis and osteoclast activity (orange). (D) Tumour growth and osteolysis leads to thin and easily-fractured bone. (E) Inflammatory factors and acid release (red) leads to (F) increased nerve firing and sensation of pain. (G) Chronic firing eventually leads to negative changes in the central nervous system.

Patricia Huijnen

Patricia Huijnen is a Vancouver-based sculpture artist with a special interest in molding techniques. Originally from Luxemburg, Patricia is currently a graduate student at Emily Carr University of Art + Design. Guided by material explorations with edible and inedible materials she creates sculptural objects that involve the mouth as a sculptural tool, developing a physical, embodied vocabulary that functions as a way of speechless expression.
patriciahuijnen.wordpress.com





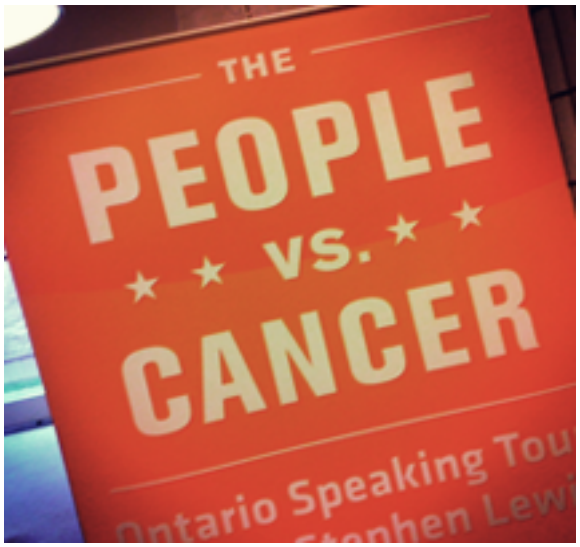
My name is Patricia Huijnen. In my artistic research and practice, I am investigating the use of the mouth as a sculptural tool as well as the manifestation of the mouth in sculptural objects as a means to suggest bodily experience. Through the use of molding processes, where I focus on the role of the mouth as mold, I develop a physical, sculptural, embodied vocabulary that functions as a way of speechless expression. The mouth is of special interest to me, as it is the figure of an in-between state, between inside and outside, private and public, sensual and repulsive. Through sculptural gestures related to the mouth like chewing, biting, spitting or spilling I transform items of edible and inedible materiality, such as candies, spoons or other objects that relate and resemble the mouth through their function, shape, texture and size, in order to investigate the suggestive power of sculptural objects and materials. The open and suggestive quality of the objects is key to allowing different interpretations by the viewer.

In the image-based work "Bolus" (2011) and "Spill" (2011), mouth-sized items – such as the volume of a spoon or a bowl that spills its content – are placed on graph paper and submitted to the grid of analysis.

News Article

Preventing the epidemic. Campaign to Control Cancer.

Aida Sivro *(University of Manitoba)*
News Reporter – HSI 2010-2011



Next to cardiovascular disease, cancer has become one of the world's biggest killers. In 2007, almost 8 million people worldwide lost their lives prematurely due to cancer, and the number of cancer deaths is expected to increase almost 50% by 2030[1]. Based on the current incidence rates, an estimated 40% of Canadians will develop cancer during their lifetime[2].

At the same time, the number of cancer deaths can be cut in half by applying knowledge we already possess. Worldwide, the most common types of cancer that kill men are lung, stomach, liver, colorectal and oesophagus, and for women, common types include: breast, lung, stomach, colorectal and cervical. One fifth of these cancers are caused by chronic infections, such as Human papillomavirus (HPV) that can lead to cervical cancer and hepatitis B (HBV) that has been linked to liver cancer. Additionally, tobacco use is the single largest preventable cause of cancer in the world.

More than 30% of cancers can be prevented, mainly by avoiding tobacco use, having a healthy diet, being physically active and preventing cancer-causing infections. At the same time one third of cancers could be cured if detected and treated early. Even in late stage cancer, quality of life could be significantly improved if current knowledge about pain control and palliative care were applied more frequently.

Controlling cancer through knowledge change and action is something that people like Pat Kelly, CEO of the Campaign to Control Cancer (C2CC), have been advocating for years. Pat Kelly started her career in advocacy in 1987 when, as a young mother, she was diagnosed with breast cancer. Since then, Ms. Kelly has helped to establish networks of patient-support groups and has authored numerous publications, including six editions of the book *What do we need to know about breast cancer*.

The following are excerpts from an interview with Ms. Kelly regarding her work with C2CC and the "People vs. Cancer"- an Ontario Speaking Tour with Stephen Lewis. Organized by C2CC, the "People vs. Cancer" tour was brought to five Ontario universities. The tour also saw the launch of Community Conversations as a part of the *Go Public* initiative to raise public awareness, as well as provide a platform to share experiences and perspectives on cancer and cancer control.

[AS] The "People vs. Cancer" – Ontario Speaking tour was joined by Stephen Lewis, the former Canadian ambassador to the UN and special UN envoy on HIV/AIDS in Africa. Why did you choose Mr. Lewis and what was his main message regarding cancer control?

[PK] *Stephen Lewis has always been a champion of social justice. We have a lot of messages about cancer that go back almost a hundred years. In fact, they tend to be the same messages of investing in research and that our hope lies somehow in the future. In Canada and internationally, people are running for the cure or they are involved in public engagement efforts that focus on donations rather than on truly taking ownership of this idea that we can control cancer. It is not about bad luck, bad genes, and bad habits. We wanted a spokesperson who wasn't recognized as one of the traditional leaders within a cancer movement. In fact, we wanted somebody who is recognized as a leader in some other field to bring a different perspective to this idea. Stephen Lewis is an icon in the AIDS movement because his message is that people living with the disease have, in fact, the greatest capacity to influence and make change happen. And when you inspire others around a social justice issue, you build a momentum that is needed to make change happen. Canada has a national AIDS strategy in part because of people like Stephen Lewis, who said that it is not enough that people who live with this disease fight for themselves, the rest of us*

have to get involved. We wanted to have someone who had that capacity to galvanize, particularly young people, because that is where change will happen. The cancer movement has been dominated by cancer researchers and very conservative cancer charities, and the message about what taking control means is one that I do not think has been taken up by people of that generation. So the voice of Stephen Lewis, not a cancer activist but rather a social justice activist, and his message was: we can all take control of this; all of us have something that we can and will do.

[AS] Through the 'Community Conversations on Cancer', close to 1,500 Canadians participated in the *Go Public* initiative to characterize public awareness, experiences and perspectives on cancer. From this, the 2010 Report on Community Conversations[3] states that more than half of the Canadians that participated could not correctly estimate their risk for cancer and were not aware that around half of cancers are preventable.

[PK] *It is always surprising to learn that the prevalence of cancer is still not well understood within the population, and many elected officials that we meet with are surprised when we tell them that almost half of cancers are preventable. A lot of messages around cancer have been related to fundraising. Part of the challenge is to convert people from being donors or fundraisers to people who take action on an issue. We have to stop positioning cancer as a war because it sort of suggests that it is a win-loose environment. No! These small steps really make a difference: five to seven fruits and vegetables a day for you, for your kids, for your family; get screened; don't smoke; raise the cost of cigarettes and you really have a dramatic impact on youth smoking. Don't ignore what is right in front of you on your plate. What are the choices you make in the grocery store, because those will contribute as much to you and your family's risk for cancer as whether or not you live within a hundred yards of a power line.*

[AS] How can ordinary people and students help in the fight against cancer?

[PK] *We want you to join the Campaign to Control Cancer. Not just because we have something we want to get from you, but we believe that there is something you can give to this: your passion, your awareness, your creativity, your name, and your online presence. All of that will certainly influence your behavior and other people's behavior, but being part of the collective is what ultimately builds the momentum you need for social change. And students are in that time in life when you are making life style choices about diet, exercise, smoking, stress in your life, what you choose for your career. Many opportunities in oncology going forward; an aging population of baby boomers means there is going to be a lot of cancer, which means there are going to be a lot of jobs related to that. Look at the personal choices that you make, in terms of a career choice, look seriously at the options in health, social and political sciences and public policy, and join our campaign. Don't underestimate the power of students to have an impact.*

Cancer affects everyone, rich and poor, young and old, men and women all over the world, and inflicts enormous strain on families and societies. While knowledge about cancer treatment and prevention is continually growing, the number of new cancer cases is increasing globally. It is time to translate current knowledge into action in order to save lives and improve quality of life. Each one of us has an important role to play in achieving a common goal – to control cancer, because the next life we save could be our own.

For more information and to join Campaign to Control Cancer visit: www.controlcancer.ca

1 World Health Organization, http://www.who.int/cancer/media/en/GlobalActionCancerEnglfull.pdf

2 Cancer Statistics Canada 2010

3 2010 Report on Community Conversations. http://www.controlcancer.ca/storage/cc2010-toolkit/national-snapshot.pdf

News Reporter Profile

Aida Sivro is currently persuing a PhD in Medical Microbiology at the University of Manitoba as part of the CIHR International Infectious Diseases and Global Health Training Program (IID & GHTP). She is mainly interested in HIV immunology and the role host genetics plays in the susceptibility to HIV infection and rate of disease progression.

News Article

Advancements in Epigenetic Research and Its Role in Cancer Therapy

Anita Liu *(McGill University)*
News Reporter – HSI 2010-2011

In the past, cancer was predominantly viewed as a genetic disease, thus implying our biology is our destiny. In recent years, the scientific community has slowly recognized that although our DNA will not change throughout our lifetime, non-genetic factors, such as social environment, can influence the way our genes are expressed (e.g. by altering DNA methylation). These changes can be quite robust, often resulting in phenotypic changes. This phenomenon coined the term "epigenetic", which is defined as a change in gene function that does not involve changes in DNA sequence [1]. Following this discovery, a much more complex picture of cancer was painted and one Canadian scientist, Dr. Moshe Syzf, has greatly contributed to what we've learned so far.

Dr. Moshe Szyf is a James McGill professor in the Department of Pharmacology & Therapeutics at McGill University, and a pioneer in the field of epigenetics. Dr. Szyf conducts interdisciplinary research and investigates DNA methylation patterns in diabetes, epilepsy, suicide, varying socioeconomic classes and cancer. Dr. Szyf was named Scientist of the Year in 2009 by Radio-Canada alongside his research collaborators, Drs. Michael Meaney (McGill) and Gustavo Turecki (McGill), for their work on the epigenetic effects of child abuse on the human brain [2]. Health Science Inquiry was fortunate to have the opportunity to conduct an interview with Dr. Szyf, where he described how DNA methylation relates to cancer, what his lab is currently working on with international collaborators, and how cancer research has progressed throughout the years.

What is DNA methylation and how does it relate to cancer?
DNA methylation is kind of the punctuation mark of the genome, and these punctuations vary substantially from tissue to tissue. In cancer, these normal patterning of punctuations is altered. We are currently working on mapping methylation [patterns] of different cancers to see if we can get a signature and subsequently try to differentiate cancerous vs. normal cells. We don't think it's one specific mark, but rather a signature. The genome has a signature, which provides us an identity: it's almost like an iris reader in an airport, and if we can define this cancer identity we can compare it to healthy cells [to use it as a diagnostic tool].

What is your lab currently working on?
The project that we are working on right now is liver cancer with collaborators in China. Liver cancer is very interesting because early detection has almost a 100% recovery in contrast to late detection, which has a poor prognosis. Most people are diagnosed very late and thus, death is almost 100%. The challenge is that not all inflamed livers develop into cancer, so how do you detect those that are cancerous from those that aren't?

Is there a particular reason why you are focusing on liver cancer?
Not in particular. Liver cancer is very common in certain places – it's a great model to prove the principle [i.e. DNA methylation patterns can be used as a cancer detection tool], and if it works we can go to breast and prostate cancer. You want to aim for a cancer where there is no drug and if it works, you can apply it to other cancers. Also, opportunities in China are amazing; the way the medical system is organized is that it's very centralized so it's easier to recruit patients and it is cheaper to conduct clinical trials there.

How long does it take for a drug to become available?
It depends on money. Clinical trials are expensive and cost millions of dollars [in China]... in the west, it'll cost hundreds of millions of dollars. There isn't an agency that funds this, especially new clinical trials – only private investors or pharmaceutical companies will. The economic climate in China is very risk adverse and they will only want to invest in clinical trials in things that they know for sure will work, but you can't guarantee that. It's unfortunate that this is the major roadblock all over the world; you need to convince somebody to throw us 6 million dollars, but you can't guarantee them it'll work.

How has research in cancer progressed over the years?

The classic definition of cancer as a molecular disease, which was very dominant in the 80s and 90s [and subsequently led to the discovery of things like oncogenes], [stems the concept] that cancer is a systemic disease. However, the cell is just a phenotype rather than the cause of the phenotype. [It's been shown now that] social stress can activate pathways that will change an expression [pattern to one] that can cause cancer. Now we understand that it's not just a network of a cell, organ, or body – it's a network of an environment, and that environment is the combination of the physical *and* social environment. There was also a whole issue of causality and doing simple experiments where you knock out one gene to see one phenotype and it was very naïve – now we realize that the same protein can be cancer promoting or cancer suppressing. So, there's a movement from a simplistic linear thinking to a circular thinking.

What are the challenges for cancer research today?

Now the challenge is to figure out these [networks of] circuits and how we design therapeutics that take into account these circuits. In the old days, we wanted to use a specific drug, but now we understand that a specific drug is a very bad idea because it only knocks out one element of a circuit, which probably won't do much.

McGill

Department of PHARMACOLOGY & THERAPEUTICS

And finally, what do you do for fun and what is the 'fun' aspect of research?

I have zero free time. I do a lot of traveling, but not for fun (for work). So, I know many taxis and hotels and I usually don't have time to see anything. But, the fun part is meeting new people [because I have many international collaborators in Asia, Europe and America] and seeing the different ways they do science. As much as science is supposed to be objective, it reflects their culture – and I think it's great! It would be very sad to see science only being done one way. So, I think it's not outside of my work, but it's the fun part of my work.

News Reporter Profile

Anita Liu is currently pursuing a MSc in Neurology & Neurosurgery at McGill University. Aside from neurology research, her interests include disseminating accurate and relevant health information to the public, promoting science and health education in Aboriginal and immigrant communities, as well as learning about new cultures.

News Article

Immunotherapy Research in Canada: Where Do We Stand?

Chan Mi Lee *(University of Toronto)*
News Reporter – HSI 2010-2011

Society is moving towards a new perception of cancer. It is no longer a death sentence, but rather a "chronic illness", according to Dr. Siddhartha Mukherjee, the author of the recently published book *Biographies of Cancer*. Dr. Mukherjee claims that "we might as well focus on prolonging life, rather than eliminating death", pointing to the extremely complicated characteristics of cancers that could arise from nearly any tissue type [1]. Does this mean we are giving up on a cure for cancer? Perhaps, but ways to better control or slow the growth of cancer would be the first step to take.

"All of us are generating cancer cells every day," says Dr. Neil Berinstein, a leading cancer vaccinologist in Canada. Our immune system normally checks for and controls any newly arising cancer cells. However, one of the strategies cancer cells use to circumvent the immune system is to suppress its function. This is where immunotherapy may play an important role in the fight against cancer. Immunotherapy aims to boost the immunological response against tumor-specific antigens and reverse the immune inhibitory and evasive mechanisms employed by cancer cells. Scientists are now focusing on improving active immunotherapies such as cancer vaccines and immune adjuvants, which enhance the immune system's ability to fight the disease, versus passive immunotherapy with biologics, which depend on the direct action of the therapeutic agent (e.g. monoclonal antibodies) for an effect [2]. Also, one should note the difference between prophylactic cancer vaccines, such as human papilloma virus vaccines (e.g. Gardasil™), for the prevention of cervical cancer [3] and therapeutic cancer vaccines like Provenge, the first FDA-approved immunotherapy treatment which sensitizes the patient's antigen presenting cells against antigens on the surface of prostate cancer cells that are resistant to advanced hormone therapy [4, 5].

Current cancer treatments include chemotherapy, radio-therapy and surgical debulking. However, due to the lack of specificity of these treatment methods, one risks damaging the normal cells. Newly reported cancer therapies include photodynamic therapy (for the treatment of skin cancers), RNA nanotechnologies, nanorobotics and oncolytic viruses [1]. While these new treatments are also worthy of further investigation, the focus of this article will be to explore the current status of Canadian research in immunotherapy and cancer vaccines, some of which have already undergone Phase III clinical trials in the US and Canada.

The Campbell Family Cancer Research Institute
AT PRINCESS MARGARET HOSPITAL

Canadians have made major contributions to the advancement of immunotherapy research, as exemplified by two scientists from Ontario, Drs. Pamela Ohashi and Li Zhang. Dr. Ohashi, the co-director of The Campbell Family Institute for Breast Cancer Research (CFIBCR) at the Princess Margaret Hospital (PMH), has demonstrated an improvement in the ability of immune cells to attack tumors in a combined interleukin-7-viral vaccine, which was published in *Nature Medicine* in 2009 [6]. Dr. Zhang, whose recent work was published in *Cancer Letters* in November 2010, has successfully propagated human-derived double-negative T cells *ex vivo* without losing their reactivity against multiple antigens, a discovery which has brought us much closer to developing novel patient-specific T-cell immunotherapies [7, 8].

Amidst the excitement, Health Science Inquiry interviewed Dr. Neil Berinstein in order to gain insight on the current research status of immunotherapy in Canada. Dr. Berinstein previously headed the Cancer Vaccine Program at Sanofi Pasteur, Canada's largest developer of vaccines for 10 years. As well as being the author of the recently published article "Strategies to Enhance the Therapeutic Activity of Cancer Vaccines: Using Melanoma as a Model," [9], Dr. Berinstein is also a leading Canadian scientist in the field of cancer vaccines at the Odette Cancer Centre at Sunnybrook Hospital. His current collaborations with colleagues in Japan, the United States and Europe, have contributed to the development of multi-antigen cancer vaccines and novel combination therapies.

According to Dr. Berinstein, research in the area of cancer vaccines in Canada is at "a relatively early stage". He also expressed his concern for the relative lack of enthusiasm in the therapeutic vaccine field at home in Canada compared to that in the United States, where multiple pharmaceutical and biotechnology companies actively take part in this type of research. Having rich grounds for clinical trials is a key aspect in therapeutic research. However, with weak public awareness and a relatively small cohort of scientists in Canada, Dr. Berinstein pointed out that there is definitely a room for improvement to promote immunotherapy research among Canadians. He then went on to give an example of a research program arising in Halifax, where despite being managed by a Canadian organization, the clinical trials took place in the United States due to better availability of experienced staff and patient numbers. In support of Dr. Berinstein's view, a recent report prepared for the Canadian Institute of Health Research (CIHR)'s division of Infection and Immunity written by Dr. Michelle French entitled "Vaccines of the 21st Century: Taking Canada to the Next Level" revealed the common views and suggestions from Canadian vaccinologists [10]. Thus, upon surveying

approximately 240 researchers engaged in vaccine-related research, as well as vaccine and immunization organizations in Canada, some important challenges were identified and are summarized as the table below [10].

Challenges	Recommendations
Research efforts need to be better coordinated.	Organize and facilitate vaccine research workshops and facilitate communication. Foster linkages between all stakeholders. Establish a vaccine research network.
Vaccine research and development is costly.	Create partnerships with funding organizations, industry, academic institutions and government to drive research and development.
There are still several major diseases for which there currently are no vaccines. As well, improved methods to formulate and deliver vaccines are needed.	Continue to support basic research. Also, develop and support strategic research initiatives.
The public lacks accurate knowledge about the safety and efficacy of vaccines.	Support behavioural, social and ethics research.
There is a gap between basic research and Phase I/II clinical trials.	Partner with industry to bridge the gap between basic science and clinical trials. Establish facilities and guidelines to allow researchers to take discoveries towards clinical trials. Create new funding mechanisms.
There are many clinical research questions that require public funding.	Provide additional and ongoing support for pre-clinical and post-licensure trials.

While the points raised in the report are relevant, there were limited sections dedicated to therapeutic cancer vaccine research. Thus, it seems that increasing awareness and support of this specific research field may be crucial to ensure the competitiveness of Canadian research on a global scale. Additionally, though there are movements to improve the research environment in Canada, such as CFIBCR's plan to expand their immunotherapy research program at PMH [8], Dr. Berinstein suggests that "we need more incentives from the government", a sentiment that echoes the results from the aforementioned survey by the CIHR. Investment into immunotherapy research in Canada as a means to fight and control cancer may help to retain highly trained research scientists in the country and bring long-term benefits to our health care system and patients.

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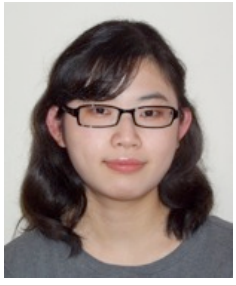

News Reporter Profile

Chan-Mi is a Ph.D. student at the Hospital for Sick Children (SickKids Hospital) in Toronto, undertaking a research project in lung inflammation. She has a M.Sc. degree from the Department of Laboratory Medicine and Pathobiology (LMP), University of Toronto, where she was involved in cancer research. She joined the HSI Team as a Newsreporter in 2010, and chose to explore immunotherapy as the topic of her article based on her interest in personalized medicine and the natural healing potential of the immune system.

News Article

New Alberta Coalition Aims to Tackle Cancer Through Healthy Public Policy

Janis Geary *(University of Alberta)*
News Reporter – HSI 2010-2011

In the fall of 2010, the Alberta Policy Coalition for Cancer Prevention (APCCP) launched itself into the public arena. Funded by the Alberta Cancer Prevention Legacy Fund (Alberta Health Services) in 2009, APCCP brings together a diverse group of practitioners, policy makers, researchers and community organizations with a common goal: to develop and implement healthy public policies to reduce cancer risks.

To accomplish this, the Coalition aims to achieve three main objectives: (1) increasing capacity of policy makers in Alberta to use policy as a strategy for cancer and chronic disease prevention; (2) providing leadership in the development, implementation and evaluation of policy-related activities for cancer and chronic disease prevention; and (3) facilitating the collaboration of all stakeholders to work together to enhance public acceptance of policy-related activities to address cancer risks.

The Alberta Cancer Board estimates that one in two Albertans will develop cancer in their lifetime. Across the country, cancer is the leading cause of premature death. Many cancers are preventable, and research has shown that more than 30% of cancers could be prevented by increasing physical activity, changing diets, avoiding tobacco use and alcohol misuse. Although these are all individual behaviours, changing the environment in which people make these choices can have a profound impact.

In the October 2010 media release, Coalition member Angeline Webb of the Canadian Cancer Society summed up the goals of APCCP, "Healthy public policy creates environments in which the healthy choice is the easy choice. Alberta has achieved some real success in the reduction of cancer risk factors. However, there are still key areas, where the implementation of healthy public policy can help prevent cancer".

APCCP
Alberta Policy Coalition for Cancer Prevention

According to APCCP's Policy Analyst Shandy Reed, understanding where Alberta's strengths are across the broad field of cancer and chronic disease prevention, and where there are gaps, is key. One of the first tasks for the APCCP team was to complete an environmental scan of current policy activities in schools, communities and worksites in Alberta, Canada and internationally. This information was reviewed by the provincial advisory members and informed priority-setting for coalition action. In certain areas, groups such as Coalition for a Smoke-Free Alberta and the Alberta Center for Active Living have been achieving tremendous momentum in influencing policy changes. Accordingly, the APCCP's role is to support these efforts.

In other areas that may be less developed, the APCCP has identified a lead role for the coalition in furthering the set priorities. Reed works with Ken Kyle, a well-known advocacy consultant, to identify windows of opportunity for the coalition to use the evidence and take action. Examples where APCCP will be taking a lead include - banning marketing of unhealthy food and beverage products to children in schools, promoting active living in workplaces, encouraging taxation of energy-dense, nutrient-poor food and beverages, and promoting policies on urban design and zoning that promote active living and healthy eating.

News Article

Two of the critical barriers to implementing public policies are acceptance of the public and willingness of decision makers. One of the first projects of APCCP research team was to better understand the knowledge, attitudes and beliefs of the Alberta public and decision makers regarding cancer prevention policies. 1,203 Albertans and 183 decision makers completed an APCCP survey, and the findings were shared in a media release on October 7, 2010. For the APCCP focus area on banning advertising and promotion of unhealthy foods and beverages to children under 16, 82% of Albertans and 71% of decision makers were supportive.

Even in areas where there is a high level of acceptance for a particular policy intervention, Reed says achieving policy change is a long process. "Policy work is a long road which requires a sustained effort. It's often about small, incremental changes and successes. But when it all comes together, the positive impact for the population as a whole is well-worth the effort."

"Policy work is a long road which requires a sustained effort. It's often about small, incremental changes and successes."

Although Reed points out the amount of time and effort that is required to make policy change, she also acknowledges the impact that APCCP has already had in its short life-time. Over the last six months the APCCP has participated in a number of policy consultations, provided presentations to elected and senior government officials, surveyed school trustee candidates, and launched letter-writing campaigns and media releases in support of their priorities. Already leaders in developing healthy public policy, APCCP is facilitating collaborations that could lead to implementing policies that ultimately reduce the risk of chronic disease and cancer for Albertans. "The strength of the APCCP is in its membership. Our member organizations as well as our provincial and international advisory groups bring tremendous skill and expertise to the table. These resources paired with the APCCP's ability to stay nimble and respond to opportunities as they arise, are quickly making the APCCP a force to be reckoned with in Alberta."

News Reporter Profile

Janis Geary is a 1st year PhD student in the School of Public Health at the University of Alberta. After completing her undergraduate degree in Microbiology at the University of Alberta, she moved to Edmonton to complete a Masters degree in Global Health. Since completing her masters she has been Project Manager for the Canadian North Helicobacter pylori Working Group. For her PhD, she is working on a project titled "Enhancing Trust and Communication in North-South Research Collaborations: A commons theoretical framework to equitable use and management of databases and biorepositories to support translational biomedical research".

News Article

Cyberknife Offers Novel Non-Invasive & Non-Surgical Cancer Treatment Option to Canadians

Megan Dodd *(McMaster University)*
News Reporter – HSI 2010-2011

November 2010 marked the one year anniversary of a new robotic radiosurgery treatment option for cancer patients at the Juravinski Cancer Centre JCC in Hamilton, Ontario. Cyberknife is a non-invasive & non-surgical tool used for the removal of a variety of tumours and represents one technology in a growing field of engineering advancements with medical applications introduced in the past decade.

Tom Chow, physicist at the Juravinski cancer explains that the Cyberknife is "an accelerator on an industrial robot [with the ability to] treat a small target with a very high dose [of radiation], and spare neighbouring organs". The Cyberknife produces multiple X-ray beams of high dose radiation that are directed by an image-guided software. The software targets the beams to the tumour in real time, and is designed to compensate for normal body movements such as breathing. Cyberknife has been approved for use on tumours anywhere in the body, and has already been applied to prostate, liver, pancreas, spine, brain, head and neck cancers, to name a few.

This real time imaging improves accuracy and patient comfort, allowing technicians to deliver radiation in high doses to only diseased areas and not the surrounding tissues. This also allows for increased patient comfort as other radiation systems can require patients to be secured in order to ensure accurate treatment. Due to its high level of precision, patients can receive higher radiation doses in fewer treatments with the Cyberknife.

Terrence Sullivan, President and CEO of Cancer Care Ontario, stated that "this new technology allows a level of precision that is not currently available for some cancer patients, especially for those who have tumours that are considered inoperable or surgically complex."

Support for the device was garnered from a variety of sources in the Hamilton Community. The Juravinski Cancer Centre Foundation provided $1 million to enable the acquisition of Cyberknife, and Hamilton businessman Mischa Weiscz has donated $500,000. Weiscz, prior to passing away from cancer in 2009, made the donation in support of the battles against cancer for patients and families.

The robotic treatment device in Hamilton is the first of its kind in Ontario, and second in Canada only to the Centre Hospitalier de l'Université de Montréal (CHUM) with a Cyberknife in operation since September 2009.

The JCC and its radiation program lead by Dr. Tim Whelan were selected to receive the Cyberknife by an expert panel formed by Cancer Care Ontario. Michael Sherrar, Vice President, Planning and Regional Programs, Cancer Care Ontario, noted that "Of all the regions in Canada, the JCC in Hamilton is consistently at the top for improving the cancer system". Ottawa is the next Canadian site in line to receive a Cyberknife.

"Of all the regions in Canada, the JCC in Hamilton is consistently at the top for improving the cancer system."

When asked to comment on where Canada stood amongst other nations for innovative cancer treatment technologies such as this one, Chow stated that "Canada has a pretty comprehensive national and provincial system that has worked very well. We have good cancer data and statistics. Because our system is completely publicly funded, the governing bodies actively evaluate new technologies like the CyberKnife, and fund their implementation at selected sites to evaluate their efficacy and cost effectiveness." He then added that, "[Canadians] are pretty good at determining what technologies, and where these technologies should be used in cancer treatment."

In regards to the future of the Cyberknife and other similar biomedical technologies for cancer treatment, Chow commented that "the device is still in its infancy, much like robotic surgery, and needs updated software and control systems. The hardware is capable of much more, but the software is not there".

The Cyberknife was developed at Stanford University by Dr. John Adler, and approved by the US FDA in 2001. Today there are over 150 Cyberknife systems in treatment facilities around the world. With the field of biomedical engineering on the rise, it is likely we will be seeing an increase in the number of radiosurgery cancer treatment options in the near future.

News Reporter Profile

Megan Dodd is a PhD student in Biomedical Engineering at McMaster University, where her research focuses on a gene therapy for Hemophilia B. In addition to Health Science Inquiry she also works as a coordinator for the Let's Talk Science Outreach Program and instructor for the Learning Enrichment Advancement Program.

News Article

Men of Movember and Their Motivations

Rebecca Cheung *(University of British Columbia)*
News Reporter – HSI 2010-2011

Hairstyles tend to go in and out of style, but men can't go wrong with a mustache – at least during November. It's all part of "Movember", an annual global campaign aimed at raising money and awareness for men's health, specifically men's cancers, through masses of mustachioed men.

The concept is simple – clean-shaven men agree to put down their razors for the month of November and grow out their facial hair. Throughout the month, these hairy men collect donations, which typically benefit organizations supporting prostate cancer research and associated support programs.

Donations collected from the Movember Foundation in Canada benefit the Prostate Cancer Canada (PCC), which uses the funds to develop initiatives like the Clinician Scientist Award (a 2-year grant, totaling $300,000, that is awarded to promising Canadian prostate cancer researchers) as well as expanding public education and awareness services.

Since Movember's humble beginnings 8 years ago in Australia, the project has not only expanded geographically (in 2009, more than 250,000 Movember participants and supporters from all over the world raised over $47 million), but also in meaning. Women who agree to stop shaving and waxing for the month have also been invited to participate. In addition, several individual fundraisers have opted to support other male cancer organizations, such as those promoting testicular cancer research.

Making men's health a priority

Despite these variations, for the most part, Movember's central message to raise funds for and awareness of men's health issues has remained consistent. It's the reason Movember participants like Michael Muthukrishna participated in the event last year. Muthukrishna, who grew a beard for Movember, joined up with other UBC students to raise money as a group.

"I think a lot of women's health issues, especially, in terms of breast cancer, has a big profile," Muthukrishna said. "Prostate cancer has a much, much smaller footprint."

Prostate cancer continues to be a concern for Canadian men. Last year, there were approximately 24, 600 new cases. Each week in Canada, approximately 470 men are diagnosed with prostate cancer and 80 men die from the disease, according to the Canadian Cancer Society website.

Bringing men together

Movember is also an effective way of building a sense of community among men. For instance, Timothy Shah, a graduate student at UBC, was inspired to grow his moustache after his classmates and friends circulated emails encouraging him to participate.

"This is my first year doing [Movember] because I was in a more supportive environment," said Shah. "There were a bunch of guys, some guys were actually doing it for the first time too. We did it together, in spite of how bad we looked."

Shah organized a Movember ping-pong tournament at his residence hall, raising over $100 from participants and spectators. He also collected about $60 from friends and family throughout the month.

Besides bonding over facial hair, Shah believes that Movember's significance lies in its capacity to bring men together to fight for their health.

"There are quite a few men who are affected by this [prostate cancer]. It's a significant problem," he said. "For Men, this is our way, for the month of November, to get together and say this is something we are going to try and fight."

"There's a bit of teasing that goes on. But it's all part of the journey."

Movember and Beyond

Support for Movember has increased steadily in Canada. Every year, across the country, workplaces, restaurants and bars held Mo-themed galas and parties.
Between 2008 and 2009, participation jumped by 273%. And last year, Canadians raised $7.8 million, according to the Movember website.

The genius of Movember is that it's a fun, cheap, unique way of getting Canadians engaged in relevant men's health issues – and it's certainly amusing to supporters.

"There's a bit of embarrassment," Shah said. "There's a bit of teasing that goes on. But it's all part of the journey."

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News Reporter Profile

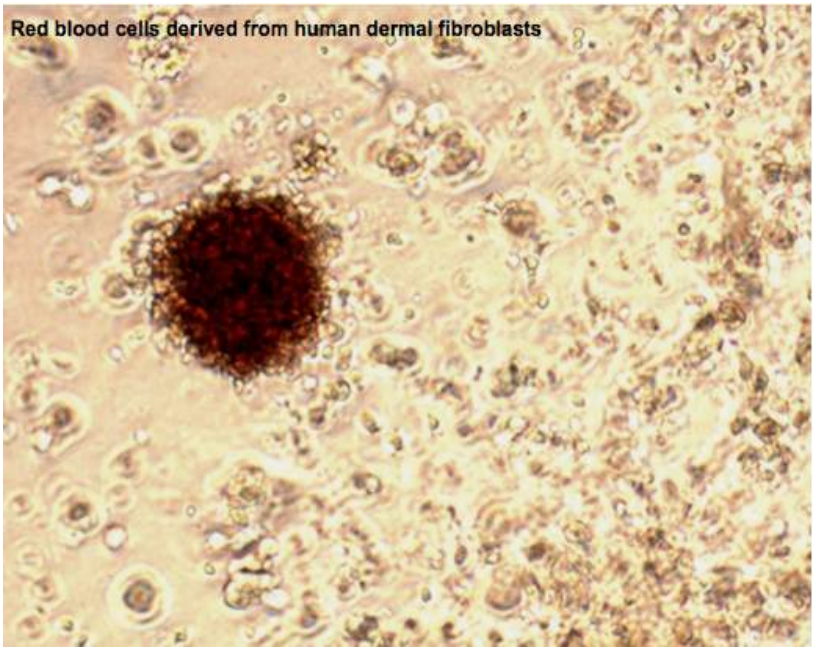
Rebecca Cheung is a freelance journalist with degrees in Life Sciences and Physiology. She is a currently completing her graduate studies at UBC's Graduate School of Journalism.

News Article

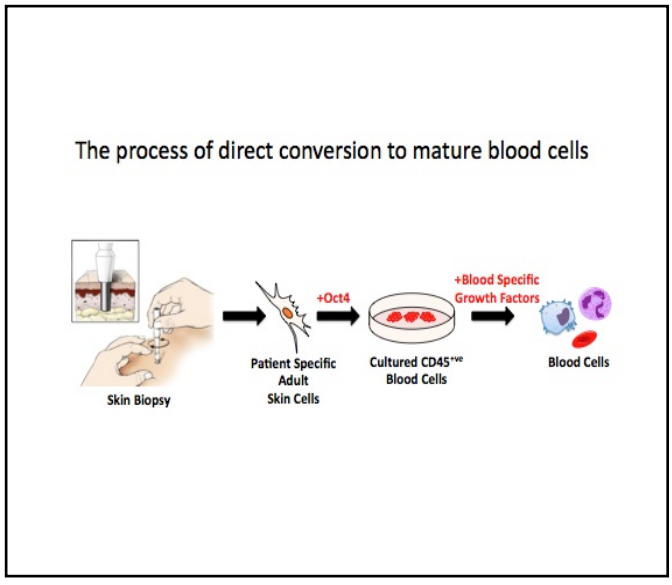
McMaster Breakthrough May One Day Decrease Patient Reliance on Blood Donors

Sean McFadden *(McMaster University)*
News Reporter – HSI 2010-2011

A groundbreaking discovery at McMaster University shows great promise in eliminating the reliance upon blood and marrow transplants by cancer patients. Dr. Mick Bhatia and his research team recently discovered that a specific protein cocktail has the potential to transform adult skin cells directly into platelets and red blood cells. Dr. Bhatia is a Canadian leader in stem cell biology and the director of McMaster's Stem Cell and Cancer Research Institute (MSCCRI). Dr. Bhatia's finding has made him a pioneer in the stem cell field, allowing scientists to transform human skin directly into functional blood cells. This discovery will have profound ramifications for the field of stem cell biology. It provides hope for cancer patients, especially those suffering from leukemia, who rely heavily upon blood bank donations.



When asked what previous research was most influential to his recent discovery, Dr. Bhatia identified two studies. The first demonstrated the potential of stem cell research, when Ian Wilmut cloned the first mammal, a sheep named 'Dolly.' "This told us a very important thing: that cells can reprogram. It showed that DNA is very plastic and can be manipulated." The next important finding came from Shinya Yamanaka, who showed that fully mature cells from a mouse or human could be reverted to a pluripotent state, meaning that the cell has the potential to turn into many different tissue types. "This finding showed that scientists could create in a lab, at a cellular level, the events that occur during development, inducing cells to become specific tissue types." These two studies paved the way for future breakthroughs in stem cell research and provided the means to study cancer using stem cells.

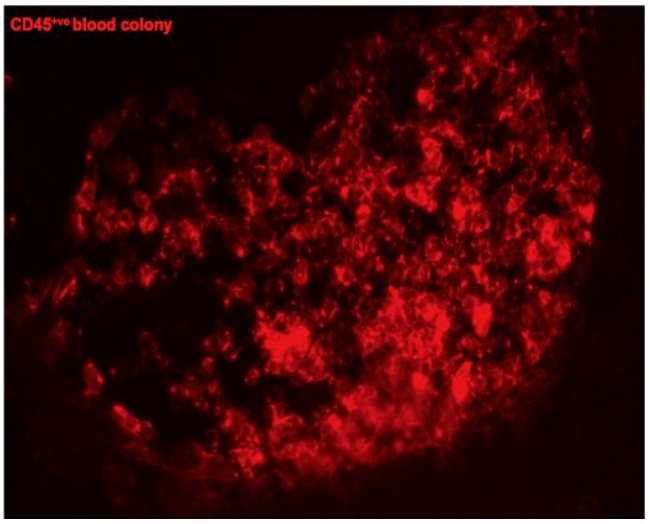


The insights that can be gained from studying stem cells and their effects on cancer treatment are twofold. Firstly, it is important to note that the most significant thing that a cancer cell does is proliferate. This is also an inherent trait shared with undifferentiated stem cells. Stem cells in their normal condition need to stay in the self-renewal process while also staying undifferentiated; this is an important feature shared by cancer and stem cells, and is something that researchers at the MSCCRI are currently trying to exploit. "When you think of the analogy of a car with an accelerator and a brake, cancer cells are not able to hit the brake, whereas stem cells can. It is the task of scientists to find out what this brake is to stop the process of cell proliferation." Slowing or stopping the replication of cancer cells would allow for more specialized chemotherapy and treatment options for those battling cancers.

News Article

The second insight gained from studying stem cells, useful for improving cancer treatment techniques, is deciphering what factors are necessary to commit developing cells to a specific tissue type. This issue is addressed in Dr. Bhatia's most recent publication. "What our group set out to accomplish was to look empirically through many different transcription factors to identify specific genetic and epigenetic changes which would allow us to differentiate skin cells directly into blood, without reverting first to a pluripotent state." Differentiating the skin directly into blood is important for a number of reasons. One reason is that by doing so, this method removes the risks associated with the use of pluripotent cells, one of which is the formation of dangerous tumors. Dr. Bhatia's method is also unique because the use of adult tissues does not carry the same ethical stigma as embryonic stem cells.

The method for inducing skin cells to differentiate into other functional cell types provides scientists the opportunity to begin creating other important tissues. In fact, Dr. Bhatia's lab is already pursuing the task of transforming adult tissue into neural cells. Such an achievement could help the scientific community understand and create more focused treatments for neurological illnesses such as Huntingon's and Parkinson's disease. Dr. Bhatia's laboratory is also investigating the potential conversion of skin cells directly into white blood cells of the lymphocyte lineage. These are the B and T cells which provide the body with its immunity against infection. A readily available source of these white blood cells could one day help to treat patients who are immunocompromised, particularly those undergoing chemotherapy or suffering from AIDS.



This recent discovery from the Bhatia lab emphasizes the importance of stem cell research in contributing to the current state of knowledge on illnesses such as cancer, as well as the cells' ultimate potential as an effective treatment option.

Images provided by Dr. Mick Bhatia, director and senior scientist at McMaster's Stem Cell and Cancer Research Institute.

Images on Page 26 & 27 are provided by Dr. Mick Bhatia, Director and Senior Scientist at McMaster University's Stem Cell and Cancer Research Institute

News Reporter Profile

Sean McFadden is currently pursuing a MSc degree in Physiology from the University of Toronto. His project is investigating the mechanisms through which hormones regulate neuropeptide production and secretion in the hypothalamus using immortalized hypothalamic cell lines. His research interests include diabetes and obesity disease onset and progression, as well as reproductive disorders associated with these pathologies.

Dialogue Piece

Article #1

In search for effective treatment for human diseases, should researchers be permitted to use embryonic stem cells within their research programs?

James J. Rusthoven, MD. MHSc

The destruction of human embryos for research purposes has continued to trouble members of both religious faith and secular communities within our society. Research is moving quickly toward developing new cellular therapies using alternative sources of stem cells such as adult stem cells[1] or induced pluripotent stem cells.[2] However, some scientists continue to harvest embryonic stem cells on the assumption that their pluripotent status makes them the best source of therapies for the widest spectrum of diseases. With the large and growing number of extra embryos from *in vitro* fertilization, they are also in greater supply and possibly less costly to process and propagate than relatively rare adult stem cells. Similarly, induced pluripotent stem cells require carefully orchestrated laboratory conditions to produce them from somatic cells and they are still being characterized as to their multidimensional similarity to embryonic stems cells.

A full range of moral arguments against the destruction of human embryos for research cannot be covered in this short piece. I will touch on three issues that must be addressed to engage in a morally robust dialogue for or against their destruction for research purposes: 1) Is there scientific evidence that destroying human embryos is the only way to develop cell-based therapies for human beings with serious diseases? 2) Is there moral justification to destroy human embryos in the hope that experimenting with their stem cells will result in effective therapies for post-birth human beings with severe diseases? 3) Can we justify resisting the destruction of human embryos for research based on their moral value as human beings?

As already mentioned, alternative sources of stem cells are available and work has moved quickly in the development of therapies using adult stem cells, often but not always as tissue- or organ-specific treatments. Early clinical studies have been reported and are ongoing showing the ability of adult stem cells to replace damaged or genetically-dysfunctional tissues. The first human clinical trial of human embryonic stem cell-derived neurogenic tissue has begun but the Food and Drug Administration remains vigilant over the known risk of tumour formation by embryonic stem cells.[3] Thus, embryonic stem cells are not the only real or potential source of therapies and there are no scientific grounds to assume that they will produce the best therapies, with greater efficacy and less risk of causing harm than those produced by other stem cells. History has shown that logical scientific intuition and planning does not always lead to the most important and useful scientific discoveries, as seen in serendipitous observations such as the discovery of the bacteriocidal properties of *Penicillium* mold.

Moral assessments of the human embryo have sometimes been based on utilitarian appeals that the development of therapies to relieve suffering of post-birth human beings should override the protection of embryos. Some have argued that embryos should be treated with respect, despite killing them for research that may help others later.[4,5] However, such efforts to salvage some moral value ring hallow to the point of absurdity if sacrificing unique human individuals somehow represents respect.[6,7] There are no statements from authoritative sacred texts that clearly spell out the moral status of the embryo.[8] Arbitrary developmental cutoffs for lesser or greater moral status, such as complete organ formation, have been proposed since Pythagorus[9] and Aristotle[10,11] and are found in some Christian, Jewish, and Muslim traditions[12] but cannot be justified on rational or religious grounds.

Despite this lack of explicit clarity, traditional Jewish and Christian concepts of human value have drawn from their written scriptures as authoritative evidence that human beings are uniquely valuable as image-bearers of God. This inherent, ontic value has been interpreted by some scholars to impart full inherent human value throughout human development.[13] In addition, Christianity brought into the surrounding pagan world a large-scale change in attitudes toward the value of the human beings, particularly those most vulnerable in society.[14] If considered as some of the most vulnerable and needy members of our kind, embryos require surrogate providers and decision-makers who act in their best interest as they develop toward full functional membership, just as surrogates are expected to support designated incapacitated persons. This relational dependency throughout development has greater moral justifiability than

arbitrarily choosing biological developmental milestones on which variable moral significance can be attached through attempts at rational consensus alone.

Secular arguments have also cast doubt on the moral justifiability of destroying embryos for research. After an elegant repudiation of the moral convincibility of arguments both for and against destroying embryos for research, Don Marquis concludes that failing to respect the basic interests of human beings for research purposes is wrong, that age discrimination is wrong, and that all of us were once embryos and therefore destruction of human embryos for research is wrong. While it seems admittedly counterintuitive to give embryos the same moral respect as adults, he confesses that his intuitions carry no greater moral force and authority than anyone else. He concludes that the failure of arguments in favour of the moral permissibility of embryo destruction for research suggests that it is not permissible.[15] This would be analogous to the precautionary principle in environmental ethics wherein new technologies that might be harmful to the environment should be not not be applied until sufficient investigation of their short- and long-term impact is carried out and their safety demonstrated.

In my view, embryos are unique human beings which, placed in the proper nutritive and nurturing environment, will likely develop into unique post-birth human beings with maturing capacities to function as independent human beings. Human society should assume moral responsibility for its most vulnerable and needy during all stages of human development before and after birth. One can claim moral authority in common human opinion, intuition, or from transcendent authority beyond human authority. In a pluralistic society, I would not argue primarily for a legal ban on the destruction of human embryos for research. I would argue that funding sources and scientists be persuaded to abstain from supporting the killing of human embryos for research and to divert their resources to other sources of stem cells and methods of cell-based therapies. One might argue that the moral health of a society is reflected in how it treats the most vulnerable and needy of its members, including the unborn.

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[15] Marquis, *op.cit*., 196, 197.

Author Profile

Jim Rusthoven is a medical oncologist by training, and currently serves as a professor in the department of oncology at McMaster University. He completed his medical training at the University of Illinois, later going on to pursue a MHSc degree in biomedical ethics at the Joint Centre for Bioethics, University of Toronto. He is currently completing a doctoral dissertation on the ethics of stem cell research at Trinity College, University of Bristol in the United Kingdom.

Comments on Article #1

ESCs: The unused IVF embryo problem

The field of embryonic stem cell (ESC) research faces challenges from the moral front as well as the scientific and practical front. Dr. Rusthoven contests the use of ESCs by questioning the morality in destroying human embryos for the sake of medicine, while showing support for the use of adult stem cells as a viable alternative for cell-based therapies. While Dr. Rusthoven makes a compelling case on moral grounds, his points do not address the following argument: Embryos slated for destruction, as in the case of supernumerary embryos produced for in-vitro fertilization (IVF), can be used for science rather than wasted.

According to Canadian law, embryos can only be produced for assisted reproduction therapies.i Donors have the option of cryo-preserving their surpluses, destroying them, or releasing them for research. The issue of donating embryos for research brings a set of ethical and policy issues which cannot be covered within the confines of this response. In any case, the point is that these embryos are available for research. While the number of embryos available for ESC research is not documented, donation to research is indeed a significant option for IVF users. ii So, if this source is available for researchers, is science faced with a moral issue in using these embryos?

One can argue that other couples or individuals who want children can adopt these surplus embryos and therefore there isn't a need to destroy them or donate them to research. I would argue that the surplus embryos would outnumber the couples looking to adopt and we are still faced with the question of what to do with the remaining. Moreover, studies have shown that couples are more likely to either donate their surplus embryos to science or destroy them, rather than give them up for adoption.iii, iv So, adoption does not seem to be a feasible solution.

In my view, the destruction of a human embryo is morally wrong. However, this is my opinion based on my own morals and I do not wish to force this on others. Present Canadian law does not prevent patients from donating their surplus embryos to science nor does it prevent a patient from discarding these embryos. Given the circumstances then, I would rather have ESC researchers use the donated embryos to help advance medicine rather than have them discarded, which is wasteful.

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iv Hammarberg, K. & Tinney, L. Deciding the fate of supernumerary frozen embryos: a survey of couples' decisions and the factors influencing their choice. *Fertil Steril* **86**, 86-91 (2006).

C. Geeth Gunawardana, Ph.D. is a researcher at the University of Toronto.

On the premature declaration of ESCR's demise

The moral implications of using human embryonic stem cells for the purposes of scientific research are carefully outlined in Rusthoven's article entitled 'In the search for effective treatments for human diseases, should researchers be permitted to use embryonic stem cells within their research programs?'. Throughout the article, Rusthoven provides both evidence- and opinion-based statements to argue that the ethical barriers of using embryonic stem cells cannot be ignored, and that resources should instead be streamlined towards other forms of stem cells. While the ethical arguments presented are quite sound, a number of points require clarification.

Rusthoven states that there are 'no scientific grounds' to assume that embryonic stem cells will result in the best therapies, but this is not a fair statement. A search of the largest clinical trials registry in the United States (clinicaltrials.gov) only identifies 11 registered trials involving embryonic stem cells and human subjects, compared to the thousands of trials involving other sources of stem cells. Given the lack of clinical research involving embryonic stem cells (the first trial was only approved by the FDA in 2009), it is not possible to compare or fully ascertain the therapeutic potential of these cell types.

Moreover, embryonic stem cells continue to be investigated in the realm of scientific research, which is a testament to the therapeutic potential assigned by experts in the field. Whether or not this potential exceeds that of adult stem cells has yet to be determined, but restricting embryonic stem cell-based research will only add to the mystery, not the solution. If research in this area is halted, might the scientific community be burning bridges given that the therapeutic potential (if any) of embryonic stem cells has yet to be fully understood?

Another point of contention worth mentioning is Rusthoven's stance on abortions in the context of this discussion, which is currently not mentioned. If the moral permissibility of embryos is to be questioned, does this argument apply to abortions as well? Or is it only limited to research practices?

Finally, Rusthoven concludes by acknowledging the pluralistic construct of society and does not advocate for a legal ban against destroying embryos, all while advocating for a shift in focus towards alternative stem cell sources. If a legal ban is not implemented, what possible measures can be taken to ensure that progress in embryonic stem cells research is halted?

Wilson Kwong is a MSc candidate studying at the University of Toronto.

Response to Comments – Article #1

I would like to thank Dr Gunawardana and Mr Kwong for their thoughtful responses to my stated position on the use of human embryonic stem cells for research purposes. I will address the responses of each in sequence, then provide final closing comments.

Dr Gunawardana notes quite rightly that I do not address the question of the use of leftover embryos after attempts at *in vitro* fertilization. I chose rather to devote the limited space allowed to probe the fundamental moral justifications of preserving human embryos rather than destroying them. Dr Gunawardana states that, in his view, it is morally wrong to destroy human embryos but that this is a private moral view that should not be imposed on others. My argument that I would not *primarily* argue for a legal ban means that I would primarily present the argument against their destruction on moral grounds. In a pluralistic society, I would present my moral case, just as others might to justify their destruction, with the hope that an increasing proportion of society would be persuaded not to destroy human embryos. I would similarly try to show scientists that their choices to engage in research that destroys human embryos are moral choices, not neutral ones about which only others need to be morally concerned.

Dr Gunawandana takes a somewhat utilitarian approach to his moral objection to the destruction of human embryos in suggesting that the reality of leftover embryos IVF forces one to default to the position that they be destroyed for research. While his personal objection to embryo destruction causes him to favour embryo adoption, he feels that the realities of demand and preference would still leave leftover embryos even if embryo adoption becomes more popular. He then seems morally pinned to the wall, forced to support destroying embryos for research purposes over discarding them altogether. Based on the arguments that I put forward, I would ask: if one really feels that destroying human embryos is morally wrong, why accept IVF as a morally viable method of overcoming infertility as long as leftover embryos is a common consequence? Would it not be taking the moral high road to encourage adopting infants or children left orphaned by losing both parents to disease, war, etc. rather than become confronted with the dilemma of extra embryos as a byproduct of an imperfect technology like IVF? This is imperfect technology based largely on the morbidity of hormonal manipulation and the inability to efficiently fertilizing one embryo at a time *in vitro*, then implanting one at a time *in utero*. With the likely need for repeated attempts before successful implantation, the costs are prohibitive for most couples and any moral concerns about dealing with extra embryos are overridden by this financial reality.

Mr Kwong feels that my statement that there are no scientific grounds to assume the superiority of embryonic stem cells as the eventual source of the best therapeutic products of stem cell research is not a fair statement. Though I understand his rebuttal, I stand by my statement. In my judgment, considerable uncertainties around the tumourogenic potential and biological stability of differentiated cell products of embryonic stem cells versus adult stem cells are a major concern. This does not give me confidence that embryonic stem cells will have a better chance of creating stable, safe, biological therapies, even if the moral concerns are not considered. Rather, I think the reasons for favouring embryonic stem cells are often of a more practical nature, such as relative ease of access and less cost.

Of greater concern to me is the way the arguments usually go. That is, rather than taking a moral stance and then determining a direction of scientific study that follows that moral stance, the direction of the scientific pursuit is often chosen and driven by innate curiosity, funding practicalities, career decisions, etc. Only later are the moral implications addressed. In my view, this is a symptom of a larger societal priority for finding solutions to human problems through science at the expense of moral consequences rather than routinely incorporating moral consciences and implications carefully into choices of scientific research direction. Mr Kwong concludes by questioning what possible other measures could be taken to ensure that the killing of human embryos for research would be halted. My answer is that legal banning will not improve the moral position of a society. At best it will satisfy the contention of a minority that legal restriction will lead to improvements in moral attitudes. I think history shows that legal prohibitions do not change morality; they generate black markets.

I might not object to a legal ban. However, in a democratic and pluralistic society I would rather advocate for persuading others that destroying human embryos for research purposes is not the direction to go. Science has resulted in amazing and helpful discoveries but also has a history of major discoveries based on serendipitous observations or counterintuitive results. I actually have considerable faith in the versatility science, in its ability to circumvent obstacles to what appears at first glance to be the best or only way to move forward. I think we are morally stronger as a society if we value ourselves as human beings similarly at all stages of development and at all levels of cognitive and physical capacity. If those less developed or capable are considered equally deserving of nurturing and protection by those who are more fully developed and capable, I think it would be morally better to choose other sources of human stems cells for research on new therapies. Given what we have already seen with induced pluripotent stem cell research, I feel that such research directions will bear worthy therapeutic fruit if the science is done well.

Dialogue Piece

Article #2

The ethics of animal research: A neuroscientist's view

Nicholas D. Vesprini, PhD (Candidate)

While important, discussions concerning the use of animals in scientific research are often repetitive and limited in scope and range. Such discussions seek to establish whether it is morally acceptable to use animals in research; however, a fuller assessment of the morality of animal research would require that all aspects of one's actions be examined. If the reasoning behind a number of commonly used arguments (*e.g.*, the Greater Good argument) is applied beyond the context of scientific research and used in everyday life it becomes obvious that one cannot act in a morally consistent manner. I wish to emphasize the point that the use of animals in general is based on an all-or-none principal, and in most cases, actions taken to truly act morally are not possible. As such, all persons eventually reach a point where their morality is compromised on practical grounds.

On Animal Rights: One argument used to justify the use of animals in research has been "the Greater Good" argument. This position holds that the sacrifice of a few animals is warranted if it results in an overall benefit to society through the advancement of science. Such benefits are not restricted to human persons, but also extend to animals. Dissenters argue that a deontological approach* towards animal research is required, where the methods used to acquire scientific data should be a determining factor as to whether a research project is morally acceptable. Others argue that sacrificing an animal violates the rights of that animal. Therefore, any scientific insights or products generated using animals as experimental subjects are immoral by nature, since the discoveries have been made at the expense of the inherent rights of animals. If we extend this logic into everyday life it quickly becomes apparent that most of society is, at some level, acting immorally. For example, since the use of animals as a food source requires a sacrifice of livestock, we would be obligated to deem this act as morally unacceptable since it violates an animal's right to life. Despite a need for sustenance one would act immorally if he or she were to consume animal-based foods. Surely if the use of animals in research (arguably a "worthy" cause) is not socially acceptable, then satisfying one's dietary needs could be deemed a crime of selfishness and luxury. Despite the presence of alternative diets (*i.e.*, vegan/vegetarian) it would appear that the vast majority of society readily and without conscience consumes animal-based foods. One could argue that society in general is unwilling to recognize the rights of animals, act in a truly moral manner and thus turns a blind eye towards the use of animals as a food source. This demonstrates the all-or-none principal I spoke of earlier, in which animals are either selectively used as we see fit, and thus are used immorally, or are left completely untouched and morally secure. While there may be a great deal of support against the general use of animals in research, I am uncertain whether society as a whole would welcome and embrace an alternative lifestyle simply to ensure conservation of our moral integrity.

Animal & Higher Capacities: Another point that is often raised when arguing against the use of animals in research is that, in the pursuit of beneficial scientific knowledge, one must also consider the interests of the animals used (*i.e.*, a consequentalistic approach**). Of particular concern is the use of animals which are sentient or possess characteristics of "higher" intelligence. The point that is emphasized here is that animals (typically mammals) which have the capacity to perceive pain, to learn and remember, to communicate or other similar abilities should be viewed differently from those which do not. The exploitation and sacrifice of these "higher" animals represents a grave moral infraction. As such, it is argued that animals which are endowed with such capacities should be excluded from the laboratories of animal researchers. Such thinking would imply that there is a ranking of animal species, whereby animals which posses some trait would be of more value than an animal which does not possess this trait. This line of reasoning leads to the question of whether it is moral to establish and enforce such distinctions. Is this not speciesism?*** One could argue that passing such judgment based on our own ideals and values would be an immoral act, as we would be comparing species to an artificial scoring of importance. Ironically, the advancement of scientific knowledge typically changes our view of even the "simplest" animals, often revealing greater complexity than had been previously thought. This alone highlights how any ranking system would be highly tentative, variable and inaccurate. It would seem that to be unbiased in our valuation of animal species one would be need to value all animals equally regardless of their supposed importance. Alternatively, if the moral value of animal species is based on some innate characteristic, one would also have to include all species which possess this trait. For example, many invertebrates have the capacity for learning and memory[1-3] as well as (chemical) communication[4,5]; thus, if we were to use a criterion to value animals based on the ability to learn, store memories and communicate, we would not only include mammals but also virtually all other

organisms as well.

Having expanded our list of animals in need of moral protection in order to be truly moral ourselves, issues of practically arise which make everyday life unmanageable. If cockroaches and fruit flies are deemed worthy of moral consideration one would be forced to prohibit themselves from eradicating them from their homes. Driving one's car on a summer afternoon turns the windshield into a 'morality graveyard' with insect causalities that have been unjustly sacrificed for the driver's need to travel. At some point we have all killed animals which possessed some similar "saving quality" as the animals typically being passionately fought for by those who oppose animal use in research. The difference I am attempting to highlight here is that, for the sake of practically, we arbitrarily draw a line of moral duty above our victims so as not to feel immoral. Again, I would argue that an all-or-none principal is at work, whereby we either immorally value different animals based on their supposed importance (*i.e.*, speciesism), or act truly morally and value all animals equally.

Animal Use – A Proposal: I have attempted to illustrate that implementing a truly moral position encompassing both research and other animal use is beyond the scope of practically. A truly moral position would require the exclusion of all animals from any use. This is simply not possible. Compromises are made at some point or another, making us all participants in the immoral use of animals. I would argue that rather than debate the ethical use of animals in research, we could better use available resources. Our sense of morality should drive us to make the best of a bad situation. If we accept that animals are inevitably sacrificed (for multiple uses) we can direct our concern to the handling and care of animals prior to their use. Since we cannot avoid sacrificing animals, we should shift our focus to animal welfare thereby ensuring that animals sacrificed in the name of science are treated respectfully and as humanely as possible.

* *Deontological ethics* is an approach which judges the morality of an act by reference to rules and duties.
** *Consequentialism* is an approach to ethics which judges the morality of an act based on the consequences which flow from it.
*** *Speciesism* is the ascription of differing value or rights to an animal based on its being a member of a particular species.

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Author Profile

Nick Vesprini is currently a PhD student enrolled in Biological Sciences (Neurobiology and Physiology) at Brock University where he also completed his undergraduate studies. His research interests include neuronal regeneration, vitamin A, molecular biology and neurodegenerative diseases.

Dialogue Piece

Comments on Article #2

Response to Vesprini on the Ethics of Animal Experimentation

Vesprini addresses two common positions in his article – animals as possessors of rights and the ascription of moral value to animals on the basis of possessing certain higher functions. Yet, he does not so much critique these positions as trace their logic using a *reductio ad absurdum* approach. Apparently embracing these arguments he concludes that since animal use cannot practically be eliminated we must face the inevitable – the toleration of our own sustained immorality.

Yet, such a proposition seems deeply dissatisfying. If indeed animals are our moral equals, and possessors of rights, then we ought to treat them as such regardless of whether scientific progress would be impeded, or dietary adjustments required. If we would not use a child as an experimental subject, neither should we use a chimpanzee *provided they are moral equals*. Our moral duty would entail this. Where Vesprini errs is in his assent to the principle of moral equality between human persons and animals.

Animal Rights: First consider what it means to possess rights: "What matters in the having of rights is twofold: a) knowledge; b) freedom," writes philosopher D.S. Oderberg. "More precisely, a right holder must first *know that he is pursuing a good*, and secondly, *must be free to do so*. No one cannot be under a duty to respect another's right if he cannot know what it is he is supposed to respect. Similarly, no one can call another to account over respecting his right if the former cannot know what it is the latter is supposed to respect. By 'call to account' I mean making a conscious demand on them, even without speaking a word. How can a right holder make a conscious demand on another if he cannot know what he is demanding?"**1** There is no strong evidence suggesting animals possess moral knowledge. They act instinctively and therefore inhabit an *amoral* universe. Animals are not moral agents, and consequently lack inherent rights. When we assign rights to animals we project uniquely human rights – based on our moral agency rooted in knowledge and freedom – into an amoral realm. As unique moral agents, we ought to consider our obligation to animals and their welfare, rather than projecting morality and rights into the amoral animal world.

The Ethical Use of Animals: Our shared history with the animal kingdom ought to make us sensitive to their welfare, but it should not obscure the factors which make human beings unique. To some this may be textbook 'speciesism'; I maintain it is a self-evident truth. Human beings are moral agents and possess rights; non-human animals are not. In contrast to the use of humans, animal use in biomedical research does not violate their 'rights.' Our moral duty to conduct research which maximizes human – and as a by-product, animal – flourishing requires the use of animal subjects.**2** This being the case, it is also our moral duty, as Vesprini notes, to ensure proper care is provided for all animals used in experiments. I therefore conclude that when animals are treated humanely, no injustice is done when they are used to promote society's welfare.

Reference

[1] Cited in, Smith, W.J. (2010) *A Rat is a Pig is a Dog is a Boy. The Human Cost of the Animal Rights Movements*. Enounter Books. New York, NY., p.234

[2] The importance of animal research is questioned by many opponents of animal research. For an expose of this specious argument see, Conn, M.P., Parker, J.V. (2008) *The Animal Research War*. Palgrave MacMillan. New York, NY.

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Animal Experimentation: A Different Perspective

Vesprini makes two bold declarations near the conclusion of his argument stating that "implementing a truly moral position encompassing research and animal use is beyond the scope of practicality" and that a "truly moral position would require the exclusion of all animals from any use". However, there is very little argument presented in the paper to support either one of these statements.

Several examples of moral stances relating to animal experimentation are discussed, and the impracticalities of some arguments against animal use are demonstrated. However, the practicalities of arguments in favour of animal use are not really acknowledged and no counter-arguments are presented. This relates to the second highlighted statement whereby the author does not really build a strong argument as to why the discontinuation of animal use is the moral of the two options, but merely provides examples of how this argument would be presented from different theories and methods of reasoning.

Animal use is a part of virtually every human culture, and it can even be argued that it is derivative of our human nature. To condemn animal use would be to absolve the future of drug development, and possibly retract the use of therapies already on the market.

Vesprini discusses the consequentialist viewpoint relating to arguments against animal use, and I do believe as a society we have chosen to view animal experimentation largely from this perspective, but instead because we value the products of animal experimentation as being justified and worthy of the consequences to lab animals. This is perpetuated by the fact that we have all experienced benefit (directly or indirectly) from a drug or treatment derived from animal testing.

The author questions the role of speciesism in our decisions, and it's clear that as a society we do subscribe to this notion as we uphold higher standards of living for humans versus other animals. Society may not view trivial human desires as superseding the vital needs of other species; however we do view it as being moral to choose the life of a human over that of many mice.

Society views science, research and the advancement of medicine as good things demonstrated by the number of major charities in support of disease research. Vesprini discusses deontology in relation to the methods adhered to while completing animal work, but I think a deontological approach would also have us say that animal research is therefore moral in purpose because it results from adherence to these values.

For these reasons I would say that our society views animal experimentation as moral from not just one, but a multitude of ethical approaches, and it is deeply interwoven with other highly moral aspects of our society. Humans have a history of evolving societal views on morality, and society has undergone radical change to abolish what were once commonplace practices (e.g., slavery). However I would hesitate to predict such a change in regards to the moral views on animal experimentation due to our desire to prolong and improve our quality of life, feelings of self-worth and superior abilities as a species, and its connection with other things we believe to be moral and good.

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Response to Comments – Article #2

While both Dodd and Farrar raise a number of valid points, they both seem to have misinterpreted or have misconstrued a number of my original arguments; as such, I will attempt to clarify my points further. First and foremost, it is important to recognize that while I do not necessarily agree with the points raised by those who protest animal use in research, I have tried to openly state and confront their more common arguments and positions. As such, I have attempted to *directly address the issues that such groups raise* and illustrate that, by following their reasoning, animal use in all aspects of life is unavoidable.

Dodd's response largely argues that the "ends justify the means" and uses the classical example of animals in medical research. This approach, as I had stated, does nothing to address the concerns raised by animal rights supporters as such medical advancements (drugs, therapies, etc.) are simply argued to be the fruit of the poisoned tree. Dodd focuses on the benefits such advancements provide society however, those in support of animal rights would be quick to highlight that this reasoning is fundamentally flawed, as said advancements come at the cost of performing (supposedly) immoral acts. Dodd's continued statements fail to address this and instead side step the issue with discussions of the benefits such work offers to society.

A more direct way to respond to this argument posed by animal rights supporters is to address that any animal with a "saving quality" would need to be exempt from all (ie: not just research) misuse, which is impractical and rarely argued for by such groups. This point opens the door to my initial statements on specism which was misinterpreted by Dodd. When referring to specism I was not comparing humans to other animals, rather I was comparing different groups of animals to one another. I had attempted to illustrate that animal rights groups will often fight against vertebrate research (eg. "cute and cuddly" animals such as rabbits) but do virtually nothing to protect numerous invertebrates (eg. "ugly" cockroaches). If both animals have the same "saving quality" (eg. learning and memory, perception of pain, etc.) then morally they should both be excluded from research. I illustrate that this is not the case and that following such ideals is not practical or possible.

Dodd closes by exemplifying mankind's ignorance and naivety with moral concerns with a reference to slavery. If centuries of firm belief can be incorrect (and subsequently changed) this example only highlights that our current view of animal rights may indeed be incorrect. Following this, Dodd suggests that such a change would be hampered by our desire for longevity and quality of life, thus suggesting that one's greed and selfishness would impair our moral compass. Once again this emphasizes that our current stance may be incorrect, as moral decisions should not be impacted by personal advancement or greed.

Farrar's response interprets my initial article as suggesting that animals are our moral equals, which is incorrect. I do strongly argue that all animals should be treated equally, regardless of their supposed importance as many "lesser" animals possess qualities suggested to be of moral consideration in "higher" animals. I do not however argue that animals are equal to that of humans. Unfortunately, Farrar focuses his response on this misinterpretation as he finds the complications arising from moral equality to be deeply dissatisfying. He then proceeds to fabricate a philosophical framework which offers a more comfortable environment.

Farrar discusses animal rights and focuses on knowledge and freedom of a subject in question. In doing so he suggests that animals lack moral knowledge, leading to the position that this excludes them from having rights worthy of consideration by humans. This line of reasoning should be reviewed with careful scrutiny, as its implications are widespread. First, this *argumentum ad ignorantiam* approach excludes the possibility that animals do in fact have the capacity to possess this idea of "knowledge". Our inability to detect and measure this self-awareness does not rule out the possibility that it is there. Quite simply, lack of evidence does not constitute proof of nonexistence. Indeed some animals are known to act in ways that could be considered moral, showing self-restraint, responsibility and compassion.[i] Would a dog warning a stranger of imminent danger or dragging a child out from a burning building not be a moral act? If animals may act as moral agents would it not be better to air on the side of caution rather than blindly assume that *all* animals are *completely* instinctive and deprive them of moral rights?

Secondly, the notion that knowledge of rights is a requirement for moral consideration directly calls into question the rights of those who have an impaired capacity of such knowledge. If this knowledge is indeed an absolute requirement then those individuals without such knowledge - children, infants, those with cognitive deficits, etc. – would be deemed to be undeserving of moral consideration. Thankfully society at large does not agree with this standpoint, as those individuals do in fact have legal rights and by extension are also granted moral rights. The question of where to draw the line quickly becomes apparent and leads to further debate best left to other discussions.

Despite these disagreements, I fully agree with Farrar's assessment that as moral agents we should feel obligated to consider animal welfare. Interestingly, despite radically different approaches we reach a similar end point in that our focus should be that of how animals are treated. Combined with Dodd's comments it is refreshing to see a number of supporters (albeit for different reasons) for animal use in research. If nothing else, we can agree that animal use in research should continue.

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Main Submission

Nanotechnology and the promise for enhanced cancer chemotherapy

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Cancer chemotherapy has evolved since the serendipitous discovery in the 1940s that mustard gas compounds could stop the uncontrolled proliferation of white blood cells in lymphoma patients[1]. More effective whole-body chemotherapeutic agents aimed at a broad range of cancers have been developed since then; however, their success is limited by severe toxicity to normal cells[2]. Recently, targeted chemotherapies have emerged, specifically targeting cancer cell components with fewer side effects[3]. Nevertheless, ongoing issues with identifying cancer cell-specific targets, determining which patients will respond to a particular targeted therapy and the development of chemoresistance limit the effectiveness of these drugs in humans. To this end, scientists have begun to harness the potential of nanotechnology – a scientific realm that focuses on manipulating matter into cell-sized instruments – to overcome some of these issues and improve efficacy of current cancer chemotherapy[4].

A major challenge today in cancer drug development is target cell specificity. Current anti-cancer agents are administered systemically per oral or intravenous routes and diffuse throughout the body where they interact with both cancerous and normal cells, and are actively metabolized by the liver and kidneys. These actions contribute to a reduction in the therapeutic index, safety, specificity, and bioavailability of drugs[5] that may be overcome by nanotechnological approaches. Nanoparticles are polymeric or inorganic structures (ranging from 1 – 500 nm in size) designed to carry and deliver highly concentrated anti-cancer compounds specifically to tumour sites. There are two ways in which this is carried out. The passive targeting strategy exploits the inherent "leakiness" and poor drainage of cancerous tissues[6]. Smaller nanoparticles tailored for this strategy can selectively accumulate within the tumour environment to release drug cargo. In contrast, the active targeting strategy involves conjugating target ligands, which are specific to membrane receptors overexpressed on tumour cells, to the surface of the nanoparticle structure. These ligands facilitate the interaction between the nanoparticle and the tumour cell, and trigger receptor-mediated endocytosis for subsequent delivery of the payload directly into the cancer cell[7, 8].

The potential for targeted drug delivery via nanoparticles has important implications for the refinement of cancer chemotherapeutics. Researchers have begun to experiment with more traditional whole-body chemotherapies, whose side effects may have limited their use and effective dosage. In the pre-clinical setting, some of these agents have been encapsulated in nanoparticles and delivered to tumours at safe and effective doses[9, 10]. When delivered in this manner, the therapeutic benefit of these anti-cancer drugs generally outweighed the observed side effects[4]. This suggests that more research is needed to evaluate the efficacy of other traditional whole-body chemotherapies deemed too risky for human use.

The promise of nanotechnology requires that more cancer cell-specific targets and phenotypes are identified that can be exploited by these drug delivery vectors to treat various types of cancers. This is a difficult task given the fact that cancer cells hijack normal cells. Simply employing the active targeting strategy aimed at blatant tumour specific properties may also elicit adverse effects on normal cells which share these properties. For example, an obvious target in breast cancer is human epidermal growth factor receptor 2 (HER2), which is known to be amplified in ~30% of tumours[11]. While this protein is also expressed on the surface of normal cells, albeit to a lesser extent, actively targeting HER2 may contribute to normal cell toxicity. One way to potentially minimize these side effects is through the

identification of other receptors found specifically on HER2-overexpressing tumours. Gene expression profiling of a cohort of HER2-positive breast cancers may identify several putative targets which could collectively be loaded to the nanoparticle surface to ensure more exclusive drug delivery to these cancer cells. A similar strategy could be employed to identify multiple potential targets specific to triple-negative breast cancer, which is one of the most difficult subtypes to treat.

In the future, it would be imperative to test the design of a nanoparticle incorporating both the active and passive targeting strategies. This could be achieved by altering the immediate physical structure of the drug-transport vector for passive targeting, as well as refining the biochemical ligand-receptor binding properties to better identify the cancer target for active targeting. In principle, the passive strategy would ensure that most nanoparticles remain in the vicinity of the tumour environment limiting the effects of active targeting to normal cells in a particular site of the body.

Many particle-based drug delivery systems are currently being assessed in clinical trials, yet only a few have been approved and marketed for human use. This may be due to the scantily available toxicological data for these systems or the high costs associated with large-scale production[12]. With the nanotechnological realm in rapid expansion, there is still much to be explored before new cancer treatment modalities will become clinically available. Nonetheless, the future looks promising for cancer patients, biologists and drug developers alike.

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Main Submission

From diabetes to cancer: New applications for targeting AMPK in the clinical setting

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The emergence of 5' adenosine monophosphate-activated protein kinase (AMPK) as a target for cancer was unexpected and it has subsequently proven to be a small protein with big possibilities. Although AMPK is a well known indirect target of antidiabetic drugs, its potential as a cell proliferation suppressor has only recently been investigated. A growing body of preclinical and clinical research suggests activating AMPK may be the future direction in preventative and therapeutic cancer strategies.

AMPK is a major regulator of metabolism in eukaryotic cells[1]. It is a serine/threonine kinase activated by metabolic stressors which deplete ATP and increase AMP levels[2]. Once activated, AMPK can restore energy homeostasis by suppressing enzymes involved in ATP consumption and increasing ATP production[2]. Patients with disorders in which AMPK activity is decreased, including metabolic syndrome and diabetes, have an increased risk of developing various cancers[3].

AMPK has been shown to suppress cell proliferation in non-malignant and tumor cells[4]. This activity may be explained by the tumor suppressor genes that lie within the AMPK pathway including LKB1[4]. The mammalian target of rapamycin (mTOR) pathway is a key regulator of protein translation/synthesis; AMPK activation inhibits mTOR signaling limiting the amount of protein cells that have to grow and divide[4]. These observations suggest agents that activate AMPK may be useful to prevent tumor development and growth. Metformin is the most widely prescribed oral hypoglycemic drug. It is believed to have antitumorigenic effects that are independent of its hypoglycemic effects and has received attention as a novel-anticancer agent[5]. Studies have shown the mechanism by which metformin can inhibit cancer cell growth is mediated mainly by AMPK[1].

The effects of metformin on cancer mortality have been suggested to be dose-dependent[7]. Furthermore, epidemiological studies support the notion that metformin has anticancer properties as diabetics receiving this drug display a dose-dependent reduced risk of cancer[6]. But can metformin be used to treat existing cancers? Several clinical trials are currently underway to investigate the safety and efficacy of metformin in patients with breast, pancreatic and prostate cancer[1]. Phase II and III trials will compare invasive-disease free survival in patients treated with metformin versus a placebo or standard treatment[1].

In addition to possibly enhancing chemotherapy, activation of AMPK sensitizes cancer cells to the cytotoxic effects of ionizing radiation (IR)[8]. It was recently reported that AMPK is activated by IR in epithelial cancer cells and targeting AMPK pharmacologically enhanced the IR response[8]. Targeting AMPK to enhance the effects of IR may be especially beneficial for treating lung and prostate cancers in which even high doses of radiotherapy show limited efficacy[9].

Specific activators of AMPK that do not alter cellular AMP levels are currently under investigation[10]. Direct activators, such as A-769662, act more potently and effectively than metformin and in a greater range of tissues[11]. A direct AMPK activator with good bioavailability would be ideal for clinical use to prevent undesired nonspecific effects.

So is it time for the clinical development of AMPK activators for the prevention and treatment of cancer? To put it simply, not quite. Although the *in vitro* and *in vivo* evidence demonstrating a link between AMPK and cancer is compelling, the epidemiological evidence is limited by confounders and the study designs used. Only two of the ongoing clinical trials studying metformin and

cancer set out to determine the maximum tolerated dose of metformin in study patients. There is sufficient rationale to study AMPK activators in the clinical setting; however, a few issues remain to be addressed.

The safety data in cancer patients should be established. It should be determined whether there are consequences of tampering with glucose metabolism in non-diabetic subjects. The current clinical trials using metformin are short-term studies; therefore, the long-term effects of taking metformin in these individuals should be investigated. Clinical trials should provide vital information about the magnitude of the effect of metformin in non-diabetic compared to diabetic patients, since hyperinsulinemia in diabetes is considered a risk factor for malignancies[5]. The minimum dose of AMPK activators to achieve an antiproliferative effect and the maximum dose tolerated in cancer patients needs to be established. Increased AMPK activity has previously been shown to affect cardiac function[12], therefore, it is possible consequences of systemic AMPK activators may occur at the maximum dosage.

Increased mTOR activation and decreased AMPK activation have been suggested as predictive biomarkers of the efficacy of these drugs[13]. Subjects with indication of increased mTOR activity, such as S6K phosphorylation, would benefit from AMPK-mediated inhibition of this pathway due to prevention of cell growth and proliferation. There is debate whether LKB1 has to be intact for activation of AMPK; therefore, some tumors may not respond to this type of treatment[11]. Future identification of patients likely to respond to AMPK activators using these suggested biomarkers will improve the success of clinical trials.

Finally, identifying treatments to combine with AMPK activators may be most effective in the clinical setting – information which can be gained from clinical and retrospective studies. As well, using agents to activate AMPK prior to IR may provide the maximum benefit for patients receiving radiotherapy.

As new information comes forward supporting the link between AMPK and cancer, it is critical to understand the mechanisms by which it suppresses cell proliferation, however, the transition of targeting AMPK from "bench to bedside" is certainly on its way.

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Author Profile

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Main Submission

Advancing cancer treatment: A move towards individualized therapy

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In Canada, cancer has surpassed heart disease as the leading cause of death.[1] The incidence of cancer and cancer-related deaths is increasing.[1] This is likely to continue to increase in the coming years given our aging population and the fact that cancer primarily affects people over the age of 50.[1] Each year, the government and voluntary sectors spend over $400 million on cancer research in Canada.[2] Although progress has been made in the treatment of certain types of cancer, we are still far from being able to offer all patients effective treatment.

The primary goal of an oncologist is to recommend the most effective cancer treatment available. However, it is difficult to predict patient response or resistance to therapeutic agents. In order to maximize benefits from treatment, specifically to improve quality of life and to prolong survival, we must understand and address variability in treatment response. Molecular differences in malignant tissue may explain some of the heterogeneity in treatment response and provide novel treatment targets.

Currently, patients receive standardized anti-neoplastic therapy according to tumour histology and disease stage. Advancements in molecular profiling and drug development have led to the possibility of individualizing treatment according to the molecular characteristics of a patient's tumour. These new therapies target specific cellular features that are essential for tumour growth or survival. Due to the specific nature of these therapies, the side effects from targeted therapy are often milder than conventional anti-neoplastic treatments.[3] Together, molecular profiling and targeted therapy may improve upon standardized treatment by identifying molecular characteristics associated with response or resistance to therapeutic agents.

Targeted therapy in lung cancer is an area of intense research due to low efficacy of standard chemotherapy. The drugs erlotinib and gefitinib, which inhibit tyrosine kinase activity in the epidermal growth factor receptor (EGFR), are examples of targeted therapy. Response to these therapies has been associated with mutations in the tyrosine kinase region of EGFR which are particularly prevalent in Asian women with no smoking history who develop adenocarcinoma of the lung.[4,5] Thus, erlotinib and gefitinib are most effective in this particular population.[6] Molecular profiling may also be useful for selecting the most effective treatment for patients without EGFR mutations as these patients have been shown to benefit from standard chemotherapy compared to gefitinib.[7]

Similarly, targeted therapies have been successful in improving treatment for breast cancer. Approximately 20% of patients with breast cancer overexpress a growth factor receptor gene, human epidermal growth factor receptor (HER2), which is associated with aggressive disease and higher risk of cancer recurrence.[8] The development of trastuzumab, a monocolonal antibody which interferes with the HER2 receptor, has resulted in longer progression-free survival and significant improvements in survival in HER2-positive breast cancer patients.[9] This represents a major advancement in treatment of breast cancer and has contributed to a 25% decline in mortality from breast cancer in Canadian women over the last two decades.[1]

Although targeted therapy seems promising, there are concerns about the feasibility of an individualized approach to cancer treatment. These concerns are centered on obtaining and characterizing tumour biopsies in a timely manner. However, these concerns may be unfounded as a recent study in advanced cancer patients obtained tumour biopsies for all study patients (n=86)

from 9 different cancer centers.[10] Molecular profiling was then used to identify treatment targets and to select treatment regimens. All patients had refractory disease, having previously failed to respond to chemotherapy. Despite this, 27% of patients had longer progression-free survival with individualized treatment compared to their previous treatment regimens. Marked differences between therapies that would have been recommended by the patients' oncologist in the absence of molecular profiling were also reported. This study not only demonstrates that individualized cancer therapy is feasible but that it may also represent an improvement over standard treatment.

Current knowledge of the complex interactions between specific gene expression and targeted treatment is evolving, as is molecular profiling technology. Great advancements in treatment have already been made with the advent of targeted molecular agents such as trastuzumab, gefitinib and erlotinib. These agents have fewer side effects and provide more effective disease control than standardized therapy in subgroups of patients. Although thus far, molecular agents are most effective in well-defined subsets of patients, further development of targeted therapies will open new avenues in treatment for broader populations. Continued research and development of novel molecular targets and treatments are needed, but the encouraging results to date suggest that individualized anti-neoplastic therapy holds promise for advancing the treatment of cancer.

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Main Submission

Aurora kinases: A novel target for drug development

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In recent years, a novel hypothesis in cancer therapeutics has been proposed. It states that abnormal expression of aurora kinases (AURK) contributes to neoplastic transformation and carcinogenesis, and that inhibitors of AURK can provide a valuable tool in the chemotherapeutic arsenal. As such, AURK inhibitors have become a *hot item* on Big Pharma's list. So far, preclinical and clinical data point towards the inhibitors' activity against solid tumors, with mainly cytostatic effects on cancer stabilization. There is great hope in the eventual implementation of these drugs in clinical practice.

AURK are a family of highly conserved serine-threonine kinases[1,2], both in structure and in function[3]. AURK consist of three members: AURK-A, AURK-B, and AURK-C[1]. AURK-A is expressed in most human cells[1]. It is involved in the regulation of key cellular events that take place during mitosis: centrosomal function, bipolar spindle assembly and G_2-M transition[1,4]. AURK-B is ubiquitously expressed and contributes to chromatin modification, chromatid segregation and cytokinesis[2]. Functions of AURK-C are limited to spermatogenesis, and thus do not play a crucial role in cancer development.

Given their physiological functions, it is not surprising that deregulation of AURK-A and AURK-B is associated with tumourigenesis[1]. AURK-A's role in tumor development is currently the most well-defined among AURKs[1]. Overexpression of AURK-A is observed in colon, breast, pancreas, liver and bladder cancers[4]. This may arise due to gene amplification or post-translational modifications[2]. Moreover, overexpression of AURK-A in hepatocellular carcinoma has been shown to correlate with both the stage and grade of tumor[5]. In addition, AURK-A has been shown *in vitro* to enable the production of multipolar spindles, resulting in genomic instability[2] in fibroblast cell cultures. However, the AURK-A gene is not established as an oncogene due to inconsistent findings in the literature[2,4]. Given that AURK-A alone may not lead to tumourigenesis, interactions with other proteins, such as tumor suppressors, may be of importance. The interactions between AURK-A and the tumor suppressor p53, a protein involved in preventing cancer, have already been well characterized[2,4]. AURK-A can phosphorylate p53 at two sites: 1) Ser-215 phosphorylation prevents activation of p53 downstream targets[6]; 2) Ser-315 phosphorylation facilitates p53 protein degradation[7]. Taken together, these phosphorylation events may desensitize cells for apoptosis[1]. Moreover, activation of G_1 checkpoint depends on p53 status[4]. Therefore, AURK-A-induced suppression of p53 activity may allow aneuploid cells to progress through the cell cycle[1,2]. Overall, the data suggest that AURK-A, along with other factors, may play a role in promoting carcinogenesis[2].

The precise role of AURK-B in cancer development, however, is not nearly as clear[1]. Several human tumors have been observed to overexpress the enzyme[2], including lung, prostate, kidney, breast and colorectal tumors[4]. In particular, a positive correlation between AURK-B expression and the stage of primary colorectal cancer has also been reported[8]. These results were also associated with poor prognosis in patients with higher AURK-B levels[8]. Similar findings were reported in patients with endometrial carcinoma[9]. Therefore, it stands to reason that AURK-B, along with AURK-A, may also be involved in multiple pathways leading to carcinogenesis.

Uncontrolled cellular growth is one of the main characteristics of cancer[4]. Consequently, suppression of cellular division provides a means for therapeutic

intervention and treatment of multiple cancer types[1,2]. The overexpression of AURK in select tumor types, along with its associations with genetic instability and regulation of mitotic events make these enzymes an attractive target for drug development[1,4]. The potential of AURK as a drug target was demonstrated in RNA interference experiments, where gene-silencing in human cells lead to suppression of tumor growth and increased sensitivity to chemotherapy[2]. Currently, there are a number of AURK inhibitors at different stages of development[1]. AURK inhibitors may be used in combination with other available chemotherapies. For instance, doxorubicin treatment of prostate cancer cells was shown to be more effective when treated concurrently with MK0457, an AURK inhibitor[4].

The significance of AURK inhibitors in a clinical setting has yet to be determined. Ongoing phase I trials are faced with several challenges. First, the optimization of drug administration to patients in order to maximize AURK inhibition and exert minimal toxicological consequences needs to be carefully characterized. Second, there is currently no predictive biomarker to identify and select patients for AURK inhibitor treatment. Finally, despite numerous pre-clinical trials, synergistic and additive anti-cancer effects of AURK-inhibitors and existing chemotherapies have yet to be translated into clinical practice.

So, are AURK inhibitors really the '*it drugs*' of the future? As with any new chemotherapeutic agent, there are a few uncertainties associated with clinical utility of AURK inhibitors. First, the involvement of pharmacogenetic and environmental factors in drug effectiveness are not defined. Second, implications of inter-individual response variability are still unknown. Lastly, the long-term effects of treatment have yet to be determined. Nonetheless, AURK inhibitors are promising, given their roles in regulation of the cell cycle. Successful clinical implementation of AURK inhibitors will bring us a step closer to the development of superior cancer treatment.

The finish line is almost in sight, and the race to conquer cancer continues.

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Main Submission

Getting 'JAK'ed about PI3K signaling in metastatic colorectal cancer

Robert L. Myette

Queen's University

Colorectal cancer (CRC) is an increasingly common malignancy with approximately 9,100 deaths and 22,500 diagnoses having occurred in 2010 in Canada alone[1]. While new methods of detection, diagnosis and prevention are being developed, metastatic colorectal cancer (mCRC) still reduces 5-year survival to less than 10%[2]. Treatment options for CRC include surgery, radiation therapy, chemotherapy and monoclonal antibody therapy. Cetuximab, a chimeric monoclonal antibody, acts to inhibit the epidermal growth factor receptor (EGFR) and is approved for treatment of CRC[3,4]. Cetuximab binds EGFR, inhibiting the interaction between the epidermal growth factor (EGF) ligand and receptor. The EGF-EGFR interaction is known to lead to activation of intracellular effectors, including Kirsten rat sarcoma viral oncogene homolog (*KRAS*), serine/threonine-protein kinase B-Raf (*BRAF*), phosphatidylinositol-3-kinase catalytic alpha polypeptide (*PI3KCA*) and potentially other unidentified proteins[5,6,7,8]. Together, these proteins are part of an 'interactome' involving multiple layers of signaling and protein-protein interactions responsible for cell proliferation, growth, survival and motility[7].

EGFR expression is apparent in 30-85% of CRC patient tumours and has been linked to reduced survival[9]. Therefore, when considering cetuximab as a treatment regimen, it is important to understand whether downstream mutations at the intracellular level would impact the efficacy of the treatment. When *KRAS*, *BRAF* and *PI3KCA* are mutated, signaling through RAS-RAF and PI3KCA pathways goes unchecked and treatment using EGFR inhibitors would yield no results. As cell signaling spirals out of control, the normal cellular environment is now out of balance, which can lead to cancer development. This observation was made especially clear when Lievre *et al*. discovered that patients with a *KRAS* mutation were refractory to cetuximab therapy[10]. This is an important finding as 30-40% of non-responding patients will have this mutation[10]. Furthermore, studies have shown that a wildtype *BRAF* gene is necessary for response to cetuximab[8]. Lastly, *in vitro* evidence shows that cells with mutant *PI3KCA* and loss of the phosphatase and tensin homolog (*PTEN*) gene are more resistant to cetuximab therapy as would be expected since PTEN negatively regulates PI3KCA signaling[11]. However, before all of this was known, cetuximab therapy was prescribed to patients who had previously failed other treatment regimens, including single dose chemotherapy/combination therapy. When combination therapy fluorouracil and irinotecan (FOLFIRI) or fluorouracil and oxaliplatin (FOLFOX) was coupled to cetuximab treatments, increases in progression-free survival and overall survival were observed[9,10,12]. Therefore, the importance of EGF-EGFR signaling in CRC and mCRC is apparent; however to what extent it is responsible for disease is still a contentious issue.

Mutations in downstream effectors of EGFR signaling are likely responsible for varying phenotypes in CRC, as anti-EGFR therapies work in patients who overexpress EGFR without these mutations[10]. These observations have lasting implications to the treatment field because patients can be grouped into subpopulations that can be treated effectively using cetuximab, while sparing others from indirect toxicity and financial burdens. The downstream targets of EGF-EGFR signaling, RAS-RAF and PI3KCA, are the molecules that need further understanding as the current literature does not seem to account for the differences in patient response to cetuximab. Determining *PI3KCA-PTEN* mutation status in patient tumours is important to identify whether there is increased signaling through the AKT pathway, a downstream effector of PI3KCA signaling involved in cellular survival signals and angiogenesis, just as

determining the *KRAS* and *BRAF* status is also relevant.

Overall, when we consider this intertwined 'interactome', it is important not to discount the ability of other unmentioned players as having a role in pathogenesis. The JAK-STAT pathway has direct effects on PI3KCA signaling, and in normal cellular physiology, is important in transducing cytokine-mediated signaling[13]. JAK-STAT signaling could therefore have an important influence on the AKT pathway through PI3KCA signaling, resulting in increased cell survival and angiogenesis[13]. It has been shown that patients with mutated, constitutively active PI3KCA are refractory to cetuximab therapy, which may also be a consequence of JAK activity on PI3KCA[13]. *In vitro* evidence corroborates this theory, as JAK inhibition is linked to an increase in apoptosis and decreased cellular invasion by CRC cells[14].

With such a convoluted series of signaling pathways involved in CRC pathogenesis, further basic molecular research is of utmost importance. The best therapeutic approach appears to be stratifying patients based on *PTEN*, *KRAS*, *BRAF*, *PI3KCA* and possibly *JAK-STAT* mutation/expression status of the patient's primary tumour. Of course this calls into question whether or not the metastatic sites have remained genetically similar to the primary tumour, however this discussion is beyond the scope of this article.

Although stratifying all mCRC patients based on mutational status is extremely arduous with respect to cost and decreased quality of life, it is not nearly as expensive as non-specific treatment regimens. Therefore, it is only once these patients are treated accordingly that the medical community will achieve higher levels of treatment response in patients suffering from metastatic colorectal cancer.

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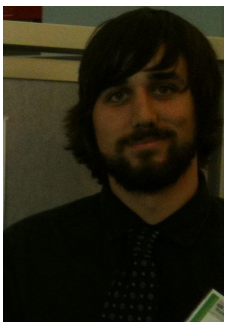

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Main Submission

The global disparity surrounding cancer treatment: How can the gap be closed?

Waqas Ullah Khan and Diane Blonski

University of Toronto

The world is witnessing an unprecedented and largely unperceived cost for inaction surrounding the treatment of cancer in developing countries. Once thought to be a problem exclusive to the developed world, cancer is now one of the leading causes of morbidity and mortality in low- and middle-income countries[1-5].

Cancer kills approximately 7.6 million people each year, two-thirds of whom are from low- and middle-income countries[2,5]. In 1970, it was estimated that 15% of newly reported cancer cases were from developing countries compared with roughly 56% in 2008[4]. This growing trend is expected to continue with the developing world accounting for 70% of newly reported cancers by 2030[3].

Blighted with poverty, low- and middle-income countries face a difficult task of managing the limited resources they possess in the fields of cancer prevention, screening, treatment, and palliative care[1]. These countries have less than 5% of the resources required for adequate cancer control, but account for roughly 80% of the disability-adjusted life years lost worldwide to cancer[1,6]. Compounding their financial burden is the grave reality that private and multilateral donors give little attention to expanding cancer prevention, diagnosis, and treatment in developing countries when compared with other diseases such as AIDS. As a result, cancer is remarkably absent from many key global health initiatives such as the Millennium Development Goals[7].

In contrast, over the last three decades, wealthy nations have made significant gains in the fight against certain cancers. For example, the USA has seen both cancer incidence and mortality rates decline since peaking in the early 1990s as a result of increased awareness, prevention, screening, and new and more effective treatment options[8,9]. Low cost and efficacious treatment strategies are now available for several malignancies including cervical, breast, and testicular cancer, and pediatric leukaemia. Unfortunately, they remain inaccessible to many individuals in developing countries.[10]

While the economic and social burdens of cancer continue to grow in developing countries, there are promising efforts underway in the fields of public policy, economics, medicine, and scientific research. If implemented, these initiatives could have a positive impact on the treatment of cancer in developing countries.

Addressing inequities in the distribution of resources by creating a coordinated financing and procurement policy targeted at reducing prices while increasing access to life-saving interventions can alleviate the burden of cancer in developing countries[10]. Many cancers that pose the greatest burden in low- and middle-income countries can be treated with drugs of proven effectiveness that are off-patent and produced generically at a more affordable price. For example, in Malawi, Cameroon, and Ghana, the total cost of a generic first-line chemotherapy drug with a 50% cure rate for Burkitt's lymphoma is less than $50 USD per patient[11].

Including cancer treatment in national health insurance programs is another alternative to help prevent further morbidity and mortality. In Mexico, the "Popular Health Insurance" program introduced in 2004 provides health insurance for low-income populations. Although the delivery of these cancer services remains suboptimal and financial sustainability is a challenge, approximately 37 million people are now enrolled in this program, which includes a range of cancer treatment entitlements[12].

Creating programs that effectively diagnose and treat cancer in rural areas of developing cancer in rural areas of developing countries through task and infrastructure shifting measures is another approach gaining attention. Many resource-poor settings are now upgrading the role of the community health promoters, nurses, primary care physicians, clinics, and non-specialty hospitals to better manage cancer and other chronic diseases[13].

International partnerships, such as the one between Partners In Health, Harvard Medical School, and the national ministries of health in Malawi, Rwanda, and Haiti also prove that gaining access to cancer treatment in resource-poor settings is feasible. In these environments, where no oncologists are available, care is provided by local physicians and nurse teams with support and training provided by Harvard-based facilities and Partners In Health. Within these institutions where cancer

treatment was once unavailable, patients are now provided with access to chemotherapy for various treatable malignancies including breast, cervical, and colorectal cancer, and Hodgkin's lymphoma[10].

Collaboration between researchers in the developed and developing world is another avenue that can strengthen the research capacity of low-income countries while balancing global research agendas with local needs[14]. Currently, 95% of research is conducted in countries that account for less than 20% of the world population[15]. To address this disparity, barriers to cancer research have been identified, which include: inadequate training, a lack of advanced technologies, the high cost of diagnosis, and limited epidemiological statistics[15].

Many cases of cancer in developing countries are treatable, yet the burden of cancer morbidity and mortality continues to grow. By targeting feasible approaches for cancer treatment and establishing clear and realistic future objectives, the international community can mount an effective and equitable response to the growing pandemic of cancer throughout the world.

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Main Submission

Is population based screening mammography starting at 40 justifiable? Benefits, risks and common sense

Deepa Singal and Tannis Erickson

University of Manitoba

In 2009, over 20,000 Canadian women were diagnosed with breast cancer and over 5,000 women died from breast cancer, demonstrating a profound burden to the health of the population[1]. Over the past two decades, screening mammography, which uses x-rays to find tumors in asymptotic women, has replaced clinical presentation as the principle means of detecting breast cancer and is currently being used throughout Canada[2]. In 2008, 74% of women aged 50-69 received a screening mammogram[3].

One of the most polarized debates among health professionals in recent years has been the value of screening mammography for women aged 40 to 49. Past research examining the value of screening mammography, usually with women aged 50 and older, has shown positive results, including a decrease in breast cancer mortality by approximately 22%. However, when reviewing the results for women aged 40 to 49, we see less of a decrease in breast cancer deaths[4]. Moreover, experts believe that about half of this decrease is due to improved treatment strategies rather than early diagnosis screening mammography[5].

The main reason for this debate is the difference we see in the effectiveness of mammography for women less than 50 years of age. Women under 40 have denser breast tissue, which decreases the sensitivity of mammography for detecting tumors. This test sensitivity is also decreased by the lower incidence of breast cancer in this age group [5,7,8]. In women aged 40-49, 26% of cancers are not seen on mammograms, versus only 10% of cancers not seen in older women[7].

The risks of screening mammography are also greater for women aged 40 to 49[8]. These risks include: increased radiation exposure, increased number of false positive mammograms and risk of overdiagnosis and treatment. A recent review of screening mammography reports a 30% rate of overdiagnosis and subsequent treatment of breast cancers[6]. Overdiagnosis occurs when screening picks up cancers that do not cause mortality or symptoms. Harm from overdiagnosis is particularly an issue for a certain kind of cancer, ductal carcinoma in situ (DCIS). Most cases of DCIS will not be associated with future invasive breast cancer but almost all women diagnosed will undergo lumpectomy and radiation therapy, some will even have a mastectomy[5]. These risks come with great psychological stress to these women and their families and are largely due to the greater number of mammograms they will have during their lifetime.

Less than 2% of women in their forties will develop breast cancer and most of these cases will be symptomatic, allowing for alternate means of diagnosis[4]. However, with routine screening mammography, all of these women would be exposed to the risks of increased screening. In a summary provided in Table 1, research shows that 40 year old women have more positive test results but fewer invasive breast cancers resulting in more false positive test results. They also have a significantly less gain in life expectancy than women in older age groups and, thus, decreased averted mortality.

Table 1: Estimated benefits & risks of annual screening mammography for 10 years in 1,000 average women [5]

	Aged 40 years	Aged 60 years
Mammograms	10,000	10,000
Positive test result	550	390
Invasive breast cancer	14	35
Breast cancer deaths averted	0.3	1.4
Gain in life expectancy	3 days	20 days

This debate has been framed by some experts as evidence versus emotion; perhaps one life saved in women aged 40-49 is worth the risks that come with screening to the rest of the population. However, evidence demonstrates that as a population based intervention, screening mammography among women 40 to 49 years of age will not increase the life expectancy of the population or significantly decrease mortality. There are various ways to interpret the body of literature on breast cancer screening and this discord is evident within the medical community. Among the various organizations with published guideline statements regarding

routine screening mammography,[9,10,11,12,15,16,17,18,19,20] only the American College of Obstetricians & Gynecologists and the American Cancer Society recommend routine screening mammography for women under the age of 50.

Women with a family history or risk factors for breast cancer should discuss when to begin screening with their physician, however for asymptomatic women with no family history of breast cancer a population based screening program may cause more harm than benefit. Furthermore, in Canada where screening is covered by universal publicly-funded Medicare, screening younger women who are not at risk may take up scarce resources with little benefit, however; a cost-effectiveness analysis is needed in this area to support resource allocation to this age group. Beyond popular public opinion and potential biases of health care professionals, assessment of screening effectiveness requires an objective evaluation of evidence that the benefits outweigh the risks in asymptomatic patients. Currently, there is no conclusive evidence that suggests that the benefits of screening mammography for asymptomatic women outweigh the risks. Therefore, implementing population health programs that include this age group are not likely to improve the overall health of the population and routine screening of women from age 40-49 should not be recommended[5,12].

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Author Profiles

Deepa Singal is a PhD Student at the University of Manitoba in the Department of Community Health Sciences. Her dissertation will investigate the characteristics and health care utilization of women who give birth to children with FASD. Her research interests included health services and policy research, specifically in primary health care delivery, health and mental health of at risk children including children in care and children with FASD. She is a member of the Western Regional Training Centre Graduate Program and is a recipient of a Manitoba Health Research Council funding award.

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Main Submission

Prevention is key to halting the global silent killer – cancer

Diane Blonski and Waqas Ullah Khan

University of Toronto

Cancer- cáncer (Spanish) - rak (polish), - kanker (dutch), - 癌症 (Chinese simplified) - is a disease with no boundaries. Although cancer is often thought to only affect individuals from the developed world, over half of the 12.4 million new cases and two-thirds of cancer-associated deaths occur in developing countries[1]. Strikingly, this disease kills more individuals than AIDS, tuberculosis and malaria combined yet is often ignored in major global health initiatives[2,3]. The World Health Organization (WHO) has attributed this neglect to many misconceptions including, 1) cancer only affects developed nations, 2) cancer prevention is too expensive, 3) cancer is not preventable, 4) cancer affects primarily men and 5) cancer affects only old people[3]. In recent years, programs have been implemented to target cancer prevention. In 2007, the Global Alliance for Chronic Disease (GACD) was created with cancer being one of its top priorities[4].

It is estimated that by 2020, there will be approximately 9.25 and 5.75 million new annual cancer cases occurring in developing and developed countries, respectively[5]. With a lack of global health initiatives to prevent cancer in developing countries, a disproportionate increase in the rate of incidence is expected. Moreover, developed countries may experience greater success in cancer prevention as a result of increased policies and strategies
for prevention[6].

Many forms of cancer are ultimately preventable; however, it is still one of the leading causes of morbidity and mortality worldwide[7]. Estimates indicate that 40% of cancer deaths can be prevented[6]. Lung cancer, for example, has an incidence rate of 23 per 100 000, accounting for 1.61 million new cases diagnosed worldwide in 2008 alone, and has a mortality ratio of 19 per 100 000[5,8,9]. Although cancer mortality is expected to increase 104% worldwide by 2020, developing countries will bear the brunt of countries will bear the brunt of this burden with an increase of 144-181%. In contrast, rates in developed nations are predicted to rise only 25%[10]. One explanation for this uneven distribution of cancer mortality rates is that developed nations have made progress in the prevention of cervical, lung, and liver cancer. Conversely, the incidence of these cancers continues to rise in developing countries[5]. For example, although the risk factors are similar between developed and developing nations, 80% of new cervical cancer cases will occur in low-income countries[5].

From a global health perspective, the key to reducing cancer incidence and mortality is through primary prevention which includes the elimination of cancer-associated risk factors such as infection, smoking, inactivity, and poor diet[1,5,11]. Recently, many large-scale programmes focusing on primary and secondary cancer prevention have been initiated and are gaining momentum in developing countries[5,6,12]. Primary prevention strategies include tobacco control, immunization, treatment of infections, and healthy lifestyle promotion[5,13,14]. It is estimated that 25-30% of cancer cases in developed countries are related to smoking. Cigarette smoking is a fairly recent phenomenon in developing countries, although it is expected to drastically increase within the coming decade if anti-smoking campaigns are not implemented immediately[1]. Strikingly, by 2030 it is estimated that 70% of tobacco-related deaths will occur in developing countries, further straining their already underfunded health-care systems[12]. Internationally, tobacco-related deaths account for 60% of avoidable cancer deaths[6]. An example of a county successfully implementing an anti-smoking campaign is Brazil. Together with the help of the WHO, Brazil has experienced a 13% national reduction in smoking since 1989. China is another country integrating cancer prevention into its healthcare stratagem. Currently, liver cancer attributed to the high prevalence of Hepatitis B infection is the leading cancer morbidity in China. As a result, China's goal is to eradicate Hepatitis B infection in children by immunizing newborns within 24 hours of birth to prevent an infected mother from transmitting the disease to her child[6].

When risk factors cannot be eradicated, secondary prevention strategies can be implemented to reduce cancer risk. Measures that can reduce the growing incidence of cancer in developed nations include initiatives such as annual pap smear tests for women to detect precancerous lesions relating to cervical cancer as well as immunization of Hepatitis C patients against Hepatitis A/B[1,14]. Rudimentary, but effective, secondary prevention measures in developing nations such as visual

inspection with acetic acid programs to detect precancerous cervical lesions have also been successfully implemented in Kenya and Thailand[12]. Primary and secondary prevention programs have shown promise in decreasing cancer morbidity and mortality, but further development and tailoring of programs are still required.

The extension of preventative measures to people at risk of developing cancer is an urgent health priority. With cancer incidence and mortality rates increasing in the developing world, a concerted global effort is required to reduce the burden of illness in low- and middle-income countries. Prevention is often seen as the key to combating cancer since it results in the best health outcomes and is the most cost-effective strategy. This is especially evident in preventable cancers such as lung, cervical and liver[3,6,14]. In recent years, the international health community has united to confront the cancer pandemic by creating international bodies such as GACD[4]. In order for the momentum to continue, it is important that regional, national, and international organizations further enhance their collaborative partnerships. Although battling cancer can be complex, governments must continue to stress the importance of prevention to reduce incidence and mortality rates in both developed and developing countries.

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Author Profiles

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Waqas Ullah Khan recently completed his MSc from the Department of Nutritional Science at the University of Toronto where he also received his Honours BSc. He is currently working as a Clinical Research Associate at The Hospital for Sick Children where his research focus is on pediatric nutrition from a global health perspective and the efficacy of various minimally invasive otolaryngology and interventional radiology-based procedures. His main research interests include child health, nutrition, and global health.

Main Submission

The future of primary cancer prevention in Canada: Reaching for every ounce of prevention means reaching for equity

Lindsay Kobayashi

Queen's University

Cancer in Canada is becoming frighteningly common. In 2010, cancer was the leading cause of premature mortality[1] in our country. If current rates of increase in cancer incidence and mortality in Canada remain constant, approximately 66,000 more people will be diagnosed with cancer (a 37% increase) and 20,500 more people will die from the disease (a 27% increase) by 2030[1]. Because our demographics are shifting toward a more aged population (age is the main risk factor for cancer[1]), these numbers will likely be even higher in reality. Primary prevention is the only way to reduce cancer incidence. As the saying goes, an ounce of prevention is worth a pound of cure – and we must improve our current prevention system to address the rising cancer incidence in Canada.

Our current nationwide cancer control program is the relatively new Canadian Partnership Against Cancer, a federally funded non-profit organization established in 2006. In March 2011, the Partnership's mandate to implement Canada's national cancer control strategy was renewed for 2012-2017 with $250 million in federal funding. The Partnership is currently revising their 2012-2017 strategy, and one of their themes is "achieve[ment] of risk reduction in the Canadian population."[2] In addressing this theme the Partnership should target groups most vulnerable to cancer risk factors, which are namely Canadian First Nations, Inuit and low socioeconomic status groups. Ensuring an equitable primary prevention program by targeting these groups must be a priority for the Partnership in order to uphold their value of being "integrative and inclusive to ensure…a pan-Canadian approach."[3]

The Partnership faces great challenges in this regard over the next five years. After age is accounted for, tobacco, diet, overweight/obesity, and physical inactivity combine to account for causing approximately 60% of all cancer deaths[4]. In 2004, smoking prevalence among Canadian Inuit and First Nations living on reserve was 70% and 60%, respectively[5] (compared to 19% in the general Canadian population in 2006)[6]. Socioeconomic-based inequalities in smoking, physical activity, and diet are prevalent in Canada[7,8], paralleling socioeconomic-based inequalities in the incidence of several cancers[9,10]. The social determinants of health including income inequality, social integration, and childhood education contribute to these kinds of inequities[11,12] and represent gaps in primary prevention that the Partnership should develop strategies to cover. For instance, targeting smoking among Canadian Inuit and First Nations will require inclusive, community-based and culturally appropriate programming that can be modeled after strategies outlined in the WHO's Framework Convention on Tobacco Control treaty, of which Canada is a member[13].

While the Partnership has not been in existence long enough to demonstrate impact on cancer rates or exposure to risk factors, they are making progress regarding the above factors and others. The Partnership's CLASP program consists of seven primary prevention coalitions targeting areas such as childhood obesity, community-based health education for First Nations populations, and healthy neighbourhood design. Their CAREX Canada program monitors population exposure to occupational and environmental carcinogens. The Partnership also surveys policy concerning primary prevention to identify areas for improvement.

In continuing with these programs over the next five years, the Partnership should set targets for risk reduction. Ten years ago, a group of Swedish researchers estimated that, in the developed world, we have the ability to reduce cancer mortality rates by

approximately 50% through primary prevention alone[14]. They stated this figure will be difficult to attain, as even with optimal primary prevention there will still remain vulnerable groups, such as those previously described, who are likely to remain "refractory to the principles of good preventative practices"[14]. The Partnership should consider adopting a long-term (extending far beyond 2017) target of a 50% reduction in the overall cancer mortality rate in Canada. Meeting this target would show their prevention program is effective and equitable.

Unfortunately, five years is very short-term when it comes to cancer control. Preventing cancer to any significant degree across the entire Canadian population will require great change in our behaviours and environment, possibly taking generations to achieve. The Partnership has an opportunity to continue laying groundwork for this change over the next five years. In addition to a target for mortality reduction, targets for healthy behaviours should be considered, such as those set for Ontarians by Cancer Care Ontario in their "Cancer 2020" plan[15]. A framework targeting social determinants of health to reduce inequity in exposures and cancer rates among Canadian First Nations, Inuit and low socioeconomic status groups must be established. Informing policy, providing community support and education, supporting research, and giving a voice to these groups can be included in this framework. The road will be long, but in following it the Partnership will become closer to attaining every "ounce" of cancer prevention possible for the Canadian population.

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Author Profile

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Main Submission

Public engagement in cancer control in Canada

Michelle Cleghorn

University of Toronto

By informing the public about relevant and timely issues as well as facilitating public input in policy development, public engagement in cancer control – as with many areas of health care – can increase the fairness and legitimacy of decisions and policies made by public officials. Equally important, public engagement holds policy makers accountable to the wider public for their decisions that are supposed to serve the public's interests. In these ways it enhances accountability for reasonableness[1]. While the ultimate goal of public engagement in health care is to keep citizens' values, preferences and priorities reflected in what is essentially 'their' healthcare system[2], engagement specifically in the area of cancer control fosters education on cancer prevention while simultaneously involving the public in processes of improving cancer care delivery[3], research[4] and policy[5]. One clear example where public engagement has impacted health care guidance, is regarding patient information and choice in screening technologies for the early detection of colorectal cancer in Ontario[6].

Unfortunately, much of the literature published to date on public engagement relates to other domains of health care, and little is known about the Canadian public's values concerning cancer and its care, including those around different cancer interventions, outcomes from these interventions and how resources should be distributed among the population at need. In Canada, cancer affects approximately 45% of men and 39% of women, with about one in four individuals dying from the disease[7]. The recent paradigm shift in science and medicine towards personalized care, especially in regards to cancer treatment[8], together with greater consumerism and patients wanting options around treatment[9] brings new economic concerns to the sustainability of cancer care, as well as ethical concerns associated with biobanking and treatment allocation. For example, many new pharmaceuticals and treatments are being developed for specific groups of patients and public funding limitations raise concerns about access to innovative and potentially beneficial treatments. Cancer drugs and biologics alone now occupy 30% of provincial cancer budgets, and "the annual growth rate of oncology drug sales is roughly double that of the overall pharmaceutical market."[7] Recognizing that limited resources require hard choices to be made by authorities, public engagement could assist in the setting of difficult priorities[10] for cancer control[11], thereby helping to legitimize the deliberation or decision process utilized for making fiscal decisions.

In order to reduce the burden of cancer on the Canadian population, cancer must be controlled at the intersection of public health and health policy. From prevention, treatment and the pursuit of a cure for cancer to survivorship, public engagement can contribute to better policy development. Regarding cancer prevention, an effective public engagement process that is broad and transparent in nature would not only increase the likelihood of public opinion influencing policy making, but would also support education of the public at large, equipping citizens with appropriate information to improve their collective health. Since there is often a chronicity to cancer that arises from several co-morbid conditions, such as heart disease and chronic obstructive pulmonary disease, an ideal strategy may be to take lessons learned from a public health-chronic disease perspective and apply them to public engagement in cancer prevention and control as more literature is generally available on public involvement in chronic disease. Moreover, although cancer is unique in many of its causal pathways, several risk factors overlap with other diseases, opening up opportunities for transfer of education, policy and public opinion across conditions. For instance, the genetic components of cancer prompt

important questions around newborn screening, adult predictive genetic testing[12], etc., which comprise more general policy issues that span across medical conditions. Public engagement would also act to elicit consumer and patient preferences in terms of the diagnosis and treatment of cancer, identifying technologies[13], interventions and resource allocation models considered useful and appropriate by the public. This engagement could be employed to make similar prioritizations in cancer research and to plan the direction of future research agendas. Finally, with the goal of improving life with and after cancer, survivors should be included as active participants in the public engagement process. With a wealth of first-hand knowledge and insight into the cancer experience within the Canadian healthcare system, they have a unique opportunity to advise on health services that would be more responsive to the needs of future cancer patients.

Policy makers want to involve citizens in the decisions that affect them[14], but often do not know how to do so effectively. The positive trend in public engagement towards the use of deliberative methods (e.g. citizens councils, Deliberative Polling®) and more dialogue with the public versus one-way elicitation of public views[15], does not seem to be utilized in cancer control. If public engagement is primarily operating to improve the fairness and legitimacy of health care decision-making and policy, perhaps its effectiveness should be measured by the accountability for reasonableness framework[1]. Furthermore, public engagement could advance public health education efforts in addition to ensuring health services embody the values, preferences and expectations of both consumers and patients.

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Author Profile

Recently, Michelle successfully defended her M.Sc. thesis at the Institute of Medical Science on public engagement in health policy under Dr. Ross Upshur's supervision. In her program, she also completed the Collaborative Program in Bioethics at the Joint Centre for Bioethics. She is currently working with Drs. Jennifer Gibson and Stuart Peacock at the Canadian Centre for Applied Research in Cancer Control on 'Setting research priorities for public engagement in cancer control: A national workshop' through a CIHR MPD grant.

Main Submission

To screen or not to screen?

Ngoc-Thy Dinh

University of Ottawa

Screening mammography has long been accepted in the western world as an effective public health method for secondary prevention of breast cancer[1]. Currently, Canadian women participate in screening either through an organized program or opportunistic screening[1]. Organized screening occurs within a program where an eligible woman, based on her age and other risk factors, may refer herself directly for mammography[1]. Opportunistic screening occurs when a woman is referred by her family physician to obtain a mammogram[1]. This article aims to highlight the current controversies surrounding screening mammography and important considerations for screening recommendations in Canada.

Since its inception, screening mammography for masses has received little opposition from the general public. However, discussions surrounding the true benefits and harms of such screening have emerged over time. Advancements in treatment, reduction in risk factors (such as use of hormone replacement therapy), and more women taking control over their individual health has resulted in improved breast cancer survival[2]. Recently, a study by Kalager *et al.*[3] reported a 10% reduction in breast cancer mortality attributable to mammography screening. This was a disappointing result according to the authors who expected a reduction of 20% or more. Other researchers have publicly denounced population-based mammography screening based on certain claims of harms outweighing benefits, including excessive use of lumpectomies, mastectomies, and radiotherapy, high rate of false positive tests, and over-diagnosis[4-7].

In the fall of 2009, the U.S. Preventive Task Force updated their mammography screening guidelines by advising screening on a biennial basis for women aged 50-64 only[8]. This garnered much displeasure among women's groups who have argued that women aged 40-49 should also be screened, despite a lack of evidence for success or cost-effectiveness to support screening for this age group[9]. The reality is that screening is effective in reducing breast cancer mortality in countries that have relatively high disease incidence, including Canada. A 10% reduction[2] in disease-related mortality is a considerable benefit. The question that still remains, however, is whether this magnitude of effect is worth the associated costs. Trade-offs between the benefits, harms, and costs associated with various screening guidelines should be considered when making recommendations for routine screening. As previously mentioned, screening younger women (under the age of 50) has not been found to be as cost-effective as screening older women[9]. There is also an issue of resource capacity; a recommendation in which more women are to be screened on a more frequent basis will increase backlog and result in longer wait-times for all women, including those who are at increased risk. Consequently, the mainstream media has used these findings to propagate a concern that mammography screening may not be as beneficial as previously thought and is potentially harmful[10, 11].

Over time there have been a number of important shifts in the way women are screened within organized programs in Canada, and these policies vary regionally. For instance, the program in British Columbia actively screens women on self-referral who are aged 40-49 annually, and women aged 50-79 biennially[1]. This province also accepts women under 40, provided that they have a referral from a physician. In contrast, Ontario only actively screens women aged 50-74 on a biennial basis[1]. In addition, some provinces are phasing out the use of analog or film mammography in favour of digital mammography, which has been found to be more sensitive in picking up true cancers as opposed to false positives (suspected cancers after screen that are negative at diagnosis)[12]. These varying policies have

significant impacts on a number of outcomes, including the ability for a program to obtain adequate coverage of the at-risk population, wait-times, and costs related to screening, diagnosis, and treatment[13].

The pertinent concern that needs to be addressed is why there is so little consensus around population-based mammography screening. This is most likely due to the lack of strong evidence available to support the current practices in terms of effectiveness and efficiency. Other considerations include the assessment of the potential impact of longer screening intervals for women of moderate risk, such as screening every three years, or the impact of tailored screening for women at high-risk. The high-risk category would be comprised of women according to age, as well as family history and/or genetic predisposition. We must also consider the impact of screening vulnerable sub-groups of the population, including women with mental and physical disabilities who face challenges with not only accessing preventive care, but also accessing the health care system in general. Within the context of a publically-funded health care system, decisions regarding which services should or can be funded, and by how much, are particularly difficult to make. To date, there have been very few studies that assess the efficiency or cost-effectiveness of population-based mammography screening in Canada. Decision-makers require sound evidence to support these difficult choices and therefore it is essential that we do not accept the current state of affairs and justify activities based on what has been done in the past. Rather, time should be invested to periodically evaluate these programs to ensure that the benefits outweigh the harms, and that the related costs are reasonable or within society's willingness to pay.

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Main Submission

The malignant impact of socio-economic disparities

Sara Suliman

University of Toronto

It is undeniable that the field of oncology has made great strides to optimize methods of early detection and treatment of different malignancies. Recently, technological advancement has even established refined associations between genetic factors such as single nucleotide polymorphisms (SNPs) and proteomic biomarkers, to cancer susceptibility, such as hematologic malignancies[1, 2]. New personalized treatments to specific oncogenic mutations have also been developed, such as Gleevec; which specifically inhibits over-activated enzymes in chromosomal translocations found in B cell lymphomas[3]. Consequently, research in developed countries, such as Canada, has secured greater survival rates due to better detection, heightened awareness of risk factors by the health care community, and more efficacious treatment regimens. On the other hand, little of the newly developed technologies have been efficiently transferred to developing countries in a financially accessible manner to the public[4]. In this article, I aim to present a case for the impact of economic inequalities on the ability of patients to access care. The widening economic gap between different classes of society globally has gradually heightened the mortality risk for members of marginalized communities worldwide. Some of the gaps in access to care can be attributed to differing cultural contexts, such as the tendency to self-medicate to avoid visiting doctors[5]. However, the care gap remains largely attributable to the cost burden on individuals in most developing countries and in some impoverished areas of developed ones[6].

The common impression that cancer constitutes a relatively minor problem in developing countries relative to infectious pandemics has been steadily shifting in recent years [7]. The situation is further exacerbated in developing countries by the relatively poor health infrastructure leading to lower detection, treatment and palliative care. The inevitable consequence is that many patients present with the disease at terminal stages when treatment is more likely futile and costly. In addition, many patients cannot afford the recommended treatments, even if detected early enough to treat. For instance, the scarcity of proficient mammography facilities in Sub-Saharan Africa, and the relatively high cost to the average individual adds to the problem of late diagnosis of breast cancer[8]. In central Sudan, the majority of breast cancer patients present at stage III or later with frequent metastasis, rendering medical intervention futile [9]. This can also reflect the need to educate the public on the importance of seeking early medical attention, when feasible. For instance, the implementation of cancer advocacy organizations in certain developing countries in Asia, such as Nepal and Pakistan, is expected to increase the rate of early detection and treatment of common neoplasms[10].

The global response to infectious pandemics such as HIV/AIDS in developing countries is gaining momentum and attracting resources, including researchers and heath care professionals globally[11]. However, the perception of cancer as a public health emergency in developing countries is still in its infancy. The weak health care infrastructure in developing countries is not coincidental but can partly be traced to global forces centered in the North, like the International Monetary Fund (IMF). The IMF imposed structural adjustment programs on many developing countries in the 1990's, which stipulated curtailment in public spending on social services such as health care as a precondition to receive aid[12, 13]. The tendency to spend plenty health care resources on infectious diseases such as HIV/AIDS and tuberculosis, although honourable, has certainly eclipsed the need to fight the new cancer epidemic emerging in these countries.

In the short-term, a crucial aspect of cancer treatment in

poor countries, such as those in Sub-Saharan Africa, is to focus on the treatment of pain and symptoms experienced by terminal cancer patients through a comprehensive palliative care approach, until a sustainable framework of early screening and detection can be funded[14]. While the integration of palliative care into national health policy remains a challenge in many developing countries, some positive examples can be learned from some low-resource countries, such as Cuba, where all cancer patients receive primary care from a team of health workers, including physicians, nurses and social workers, at no cost[15].

If the disparities of access to cancer treatments were due to the infrastructure discrepancy between developed and developing countries alone, one would predict that the situation is less gloomy in developed countries. However, in the United States, the absence of fully universal health care system, still render low-income individuals and communities highly susceptible to later detection and poorer prognosis[16]. Interestingly, some countries offering universal health care, such as Canada, still exhibit a negative association between socio-economic status and susceptibility to cancer[17]. This phenomenon showcases that basic access to health care, without improving the living standards, is likely insufficient to improve risk and prognosis in impoverished communities.

In summary, socio-economic disparities remain an under-explored influential factor for the prognosis and potential survival of many cancer patients worldwide. As concerned advocates in the cancer research community, we should proceed towards establishing more equitable, and ethical allocation of resources towards the diagnosis and treatment across the board[4]. The impressive strides in cancer detection and treatment technologies should not stop. Nonetheless, a new lens addressing the inequities in technology transfer and resource distribution to all citizens of the world needs to be integrated in the cancer research agenda. This will ensure that the goal of eradicating this pandemic is truly genuine and efficacious.

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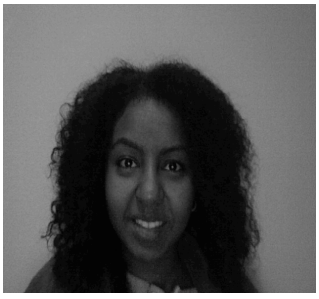

Author Profile

Sara Suliman is a PhD Candidate in the Department of Immunology, University of Toronto. She is interested in studying the pathogenesis of childhood leukemias. She is also interested in a number of public health issues, including universal health care provision and primary care in developing countries.

Main Submission

Overcoming sociocultural barriers to clinical breast examinations in South Asian immigrant women living in Canada

Sasi Shanmugarajah and C. Geeth Gunawardana

University of Toronto

On average, 1 in 9 women are expected to develop breast cancer in their lifetime; making it the most common type of cancer (next to non-melanoma skin cancer) in women[1]. Although the mortality rate from breast cancer is 15%, it has declined by over 25% since 1986[2]. This improvement in survival rate can be attributed to the development of more effective screening methods, an increase in screening participation, and advances in clinical breast examinations (CBE).

Despite this progress, current population health research reveals several barriers that influence participation in breast cancer screening programs. These barriers include the fear of pain and embarrassment, the concerns over the use of radiation, and the socio-economic status of the women[3]. One of the most significant barriers identified by Hanson *et al*. (2009) was whether or not a participant was a member of an ethnic minority. In 2006, visible minorities made up one-sixth of the total population of Canada, with those of South Asian origin representing the largest ethnic minority[4]. Immigrant women of South Asian origin show significantly lower breast cancer screening rates than Canadian-born women[5]. Studies show that information about breast cancer and screening are reaching this group but having less of an impact[3,6]. In order to understand why screening rates are lower in this population, we need to understand the socio-cultural characteristics of immigrants of South Asian origin.

South Asia comprises of several countries including India, Pakistan, Sri Lanka, and Bangladesh. Each nation is home to a variety of ethnic groups differentiated by religion, language, and social practices. Yet, within this great diversity there are core beliefs and practices that are shared amongst these groups. The work of Bottorff *et al*. (1998) suggests that these beliefs and practices play a significant role in forming barriers to breast health practices among South Asian women in Canada[7]. The following is a list of some of the regional commonalities that influence health and health care: practices among South Asian women in Canada[7]. The following is a list of some of the regional commonalities that influence health and health care:

1. Standards of modesty – Touching oneself or being touched by someone else (a common occurrence in CBE) is considered taboo.
2. Gender role – The needs of the family unit outweigh the needs of the individual. This leads to women de-prioritizing their personal health issues in favour of their husband and/or their children.
3. Superstition – Some do not want to utter the word "cancer", think about cancer, or be associated with cancer screening for the fear that one would be tempting fate.
4. Spiritual Beliefs – Believing that if it is in one's karma, a concept prevalent in South Asian culture, to develop cancer, then screening will not prevent the consequences as it is unavoidable.
5. Physician on a pedestal – The "doctor is always right" philosophy prevails in South Asian culture, and if a CBE is not suggested (for example when a person is considered low risk due to age or genetics), then South Asian women may feel uncomfortable going against the doctor's advice by asking for a CBE.
6. Family's honor and reputation – Arranged marriage is practiced in much of South Asia. A family's marriage potential is assessed by factors such as hereditary traits and health, where good health is believed to be a sign of a good 'pedigree'. Thus, women fear that the results of a CBE may tarnish the family's reputation.

Although some acculturation to Canadian customs occurs among new immigrants, many still retain traditional preferences, including views on family and religion – the core beliefs that traditional preferences, including views on family and religion – the core beliefs that support and influence the cultural barriers described above to current screening programs[8]. Organized screening programs need to circumvent these cultural undertones to overcome the breast health inequalities seen in Canada's South Asian minority.

An effective method to reach this vulnerable group is to tailor health promotion around socio-cultural characteristics. Ahmad *et al*. (2004) used such an approach on a cohort of South Asian women that showed low compliancy to CBE (less than one-third)[9]. The investigators tailored a health promotion intervention that tackled the barriers mentioned previously by the following methods:

1. Demonstrating that screening not only benefited the individual but also improved the quality of family life.
2. Encouraging women to discuss breast health with family, relatives, and health care providers.
3. Emphasizing the availability of female health personnel to overcome modesty and apprehension.

In the follow-up to the intervention, the cohort showed significant improvement in breast cancer knowledge, an increase in self-efficacy to discuss breast health, and most importantly, an increase in participation in CBE. The success of Ahmad *et al*. (2004) supports the hypothesis that socio-culturally tailored health interventions can improve breast health practices in this vulnerable group[9]. In constructing future intervention policies, we suggest the following tailored approach to the South Asian community, some of which have been highlighted by others[3,9]:

1. Direct health information not just at women, but also at their family and community, which can play important roles in overcoming the stigma of cancer in the South Asian population. These two groups can be reached through discourse on ethnic TV and radio programs. Health information articles in ethnic newspapers can also ensure that the message reaches not only women but also their families, thus promoting familial responsibility in health care. It is also important that South Asian leaders in the community, male and female, take the initiative to actively educate the population through community events.

2. Provide socio-cultural sensitive information on breast cancer that highlights the impact of breast cancer on the community and the significance and benefits of CBE. This information should also highlight the responsibility of individuals and their families to take ownership of their own health care needs, even going so far as to challenge doctor recommendations if they feel there is a real problem.

3. Address the South Asian women's need for privacy during CBE by educating physicians about this stigma. For example, doctors could use more discrete questioning practices with patients when discussing the possibility having cancer to avoid unnecessary stress. Another suggestion is to provide videos demonstrating proper self-examination techniques that can be watched in the privacy of a home. Furthermore, physicians with an understanding of the significance of "family honour" in South Asian culture can also provide more meaningful reassurance of examination confidentiality.

4. Allow female relatives or friends to attend the patient's CBE. This can go a long way in providing South Asian patients with the support they need to overcome their modesty concerns with CBE.

In summary, tailored socio-cultural health promotion and interventions methods would be more effective in ensuring breast cancer messages are understood by a South Asian immigrant audience, as the information is directly relevant to the community, commanding their attention, and reducing defensiveness to the breast cancer issue. In time, tailored intervention programs to South Asians, as well as other ethnic groups, can dramatically improve early detection of breast cancer in ethnic communities which may lead to lower breast cancer mortality rates.

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Author Profiles

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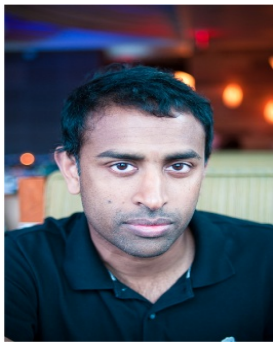

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Main Submission

Adherence to exercise in cancer survivors

Ashley Kornblum

York University

For cancer survivors living across Canada, some of life's biggest challenges begin after treatment ends. For some people, the disease or side effects of treatment can induce physical change. For others, the cancer experience can lead to a shift in priorities, bring new insight or act as an impetus to making lifestyle changes.

Many of the negative side effects associated with the clinical manifestations of cancer can be ameliorated through medical procedures. More recently, emphasis has been placed on both behavioural and lifestyle changes that require patients to take active roles in their own health and wellness[1]. The role of physical activity and exercise during cancer treatment and survivorship is becoming increasingly relevant[2].

A major concern for cancer survivors is their perceived sense of control. Upon diagnosis of cancer, many aspects of control, such as autonomy, are taken away. Physical activity allows people to take some control back. Furthermore, it is inversely related to all-cause mortality and has been linked with protection against several types of cancers[2]. Studies investigating the effects of exercise in breast and colon cancer patients have shown that a greater level of physical activity after treatment is associated with lower likelihood of disease recurrence [3], reduced treatment side effects, fewer secondary co-morbidities and improved quality of life[4-7]. Not surprisingly, discontinuation of exercise is associated with a reduction of these benefits and a return of negative symptoms[8]. Therefore, it is essential to ensure that cancer survivors clearly understand the importance of regular exercise and maintenance of a healthy weight over the long term[8].

As the benefits of exercise appear to counteract some of the detrimental side effects of cancer treatment, these benefits can only be maintained if a consistent exercise routine is adhered to. Adherence to exercise is the extent to which individuals' exercise behaviours correspond with an exercise prescription[8]. For researchers implementing exercise programs, it remains one of the most complex problems to address in healthy populations and even more so in a population ailed with chronic diseases. In a cancer population, difficulty adhering to an exercise program may be related to the cancer illness itself, potential short- and long-term effects of the treatment, time elapsed following active treatment and co-morbid conditions, in addition to a myriad of factors not specifically related to cancer that can influence the exercise behaviours of people living with cancer[3-5].

There is a body of literature focusing on the determinants of physical activity using a theoretical framework, which has been used to help better understand the behaviour changes and exercise patterns of cancer patients. The theory of planned behaviour has been applied in attempt to understand exercise adherence in cancer survivors and the results are very modest[2-5,9]. A major finding is that the strongest determinant is intention[2-5,9]. However, people have a tendency to over simplify their actions, as there are many issues and behaviours that are more complex and not easily predicted or measured by simply fitting them into theoretical models.

Understanding the knowledge, attitudes, behavioural and social skills associated with adhering to an exercise program is essential. However, there is a limited understanding in this area of research due to adherence measurement issues. A recent systematic review by Spence *et al*. emphasizes this problem with varying ways of defining adherence[10]. Despite advances in exercise interventions in cancer populations, there has not been accompanying advances in the standardization of the measurements of physical activity and adherence.

Measures of self-report and observed attendance logs are often used to assess adherence, but the method of self-report may involve possible over-estimates, or in some cases, under-estimates of physical activity and adherence. It may be associated with social desirability type responding, where participants tend to respond in a way that is viewed favourably by others or the researcher[11]. Consequently, self-reporting may not be the strongest methodology for understanding exercise adherence. A scientific consensus needs to be created regarding optimal adherence measurement so that specific hypotheses about how to increase exercise adherence can be developed, enabling long-term benefits of increased activity levels.

Currently, there is a limited understanding in exercise interventions about how to positively influence the long-term maintenance of healthy activity patterns, and to evaluate the impact of the relevant behaviour changes on long-term outcomes and benefits. While it is clear is that the effectiveness of exercise interventions largely depend on catalyzing motivation and adherence of the participant, this is an area to focus on as the improvements gained are valuable.

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Author Profile

Ashley is currently pursuing a Master of Science under the supervision of Dr. Paul Ritvo at York University. She is also a research analyst at ELLICSR - Health, Wellness & Cancer Survivorship Centre at Toronto General Hospital. Previously, she had completed a BSc degree from McGill University. Her main research interests are in health and behaviour modification in cancer patients, focusing on patients with prostate cancer being treated with androgen deprivation therapy.

Main Submission

Survivor?...The problem with labeling paediatric brain tumour "survivors"

Angela Zwiers

University of Western Ontario

'Survivor' is a common English word used in the context of health, natural disasters, social dilemmas, or even reality television shows. The term survivor describes a person with a heroic disposition, who has overcome adversity. It is important to consider the specific context and life experience of each individual when labeling him/her a survivor. Written from the perspective of someone who has endured a paediatric brain tumour, this paper explores 1) the definition and meaning of the word survivor; 2) why the word 'survivor' should be used cautiously in labeling people; and 3) alternative words that better fit those who have endured a paediatric brain tumour.

"The concept of cancer survivorship appears frequently in literature across disciplines but does not seem to have any precise definition or meaning."[1] From an oncology perspective, a survivor is "someone who is living after a cancer diagnosis for five years or longer"[2]. In the context of a paediatric brain tumour, diagnosis and treatment only mark the beginning of an endless battle. When the term 'survivor' is used, it is common to falsely assume a sense of 'cure'[3]. Despite living after diagnosis, a paediatric brain tumour survivor is far from cured. Many suffer from subsequent tumour- and treatment-related effects and remain at risk for tumour recurrence long after diagnosis and treatment. "It's like sweeping the dirt under the rug"[4], in which the term survivor fails to describe the struggles experienced well after five years from the patient's initial diagnosis. An extensive list of late effects experienced by those who have had a paediatric brain tumour can be found in any research article on the topic[5-7].

'Survivor' may be a misleading term and a misnomer. One must consider the frequency and ease at which the term survivor is used under different contexts. One can be a survivor in the context of cancer, a car accident, domestic violence or many other traumatic events. The term survivor does not predicate what one has survived. Someone who has won a reality television game show on a deserted island is identified as a survivor, as is someone who has undergone brain surgery, several rounds of chemotherapy and physical therapy to regain functional abilities. While the television 'survivor' wins a million dollars, the paediatric brain tumour 'survivor' faces several chronic physical, psychological, and social health problems for life. Is it appropriate to categorize all those who overcome any sort of adversity under a single umbrella term? With such common application, the term 'survivor' may have a minimizing or devaluating effect on the struggles paediatric brain tumour patients endure. The two cannot be equated and placed in the same survivor category. "It's…the categorizing of people to such a broad extent that we just need to pull back from that… and really look at it [survivor] on a situation by situation basis."[8]

There is a need for "a fundamental reworking of public and medical discourse around what it is to be a cancer survivor – a rewriting of the survival script."[9] In some cancer studies, the terms 'healthy survivor', 'thriver' or 'warrior' are used as alternatives to survivor[10]. The term 'healthy survivor' refers to someone who is no longer at risk for recurrence and living with a healthy sense of body, mind and spirit. 'Thriver' refers to one who is still at risk for recurrence and still struggling on a daily basis with chronic health issues. The term 'warrior' refers to one who is still at risk for recurrence, but actively fighting to gain a healthy sense of body, mind and spirit. 'Warrior' may also be quite fitting as it encompasses the constant battle. "Anybody who has fought a brain tumour [is] a brain tumour *warrior*."[11] Whatever term is used, it should clearly reflect the individual's perspective of his/her current health state as well as his/her ongoing struggles.

It is important to understand the meaning of the term 'survivor' in order for those who endured a paediatric brain tumour to facilitate development of a healthy identity. Brain tumour and other cancer survivors tend to embody the experience of their illness, identifying themselves based on their experiences, treatments, and resulting consequences[12]. Concerns over body image, sense of self, identity, and role in the social world plague young cancer patients, including those faced with a paediatric brain tumour. Former patients often struggle with learning disabilities, social skills, team participation, development of relationships, and other activities that contribute to shaping one's identity early in life[13]. Forming a healthy identity with a clear knowledge of what it means to be 'survivor' can help former patients develop their sense of self throughout life after illness.

My hope is that researchers, medical professionals, and even individuals who have suffered a paediatric brain tumour, consider the meaning of the term 'survivor' before labeling a participant, patient or themselves. Despite its positive connotation, use of the word survivor can be misleading in this instance, implying a sense of 'cure' and discounting the ensuing struggles likely to be encountered in the future. Alternative terms that better reflect the life of a paediatric brain tumour 'survivor' were discussed in this article to shed light on the topic of stereotyping those who have endured this type of cancer. This piece was written by a 'thriver'; a Masters student who was diagnosed with a paediatric brain tumour at age 16.

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Main Submission

Coping with cancer: Improving mental health support services in cancer care

Sobia Khan

University of Waterloo

Cancer is a diverse disease, and as such, patients diagnosed with cancer can experience a varying array of illness experiences that are manifest both physiologically and psychologically. Improvements in the management of disease symptoms and treatment side effects in recent years have been attributed to scientific and medical advancements, enabling the amelioration of physiological cancer experiences[1]. On the other hand, support for the psychological cancer experience may be lacking due to an absence of targeted mental health services, and potential issues with the coordination of care.

The term "cancer" encompasses a vast range of diseases that behave in different ways. There are over two hundred cancers, with unique prognoses and treatment options available for different cancer types. In his book *Cancer is a Word, Not a Sentence*, Dr. Robert Buckman states that, "by constantly referring to this large group of different diseases under the generic title of *cancer* we generate – even if it is only in the subconscious – a deep-seated fear and dread..."[2]. As such, a cancer diagnosis can be devastating to a patient, regardless of cancer type and prognosis.

The processes of treatment, follow–up and long-term management can be equally as devastating, if not more so. Research indicates that many patients experience depression, anxiety and stress both during and after their treatment, despite the severity of their illness [3]). Therapy often affects a patient's self-esteem due to obvious physical changes, such as hair loss or disfigurement due to surgery, which can interfere with social and intimate relationships[4]. The potential for infertility, cognitive impairment, chronic pain and fatigue can further reduce psychosocial functioning and quality of life. Perhaps even more psychologically challenging is the possibility of recurrence, which in itself is stressful and anxiety-itself is stressful and anxiety-inducing. It is evident that all patients may potentially have a difficult psychological cancer experience, and could benefit from mental health support.

Furthermore, targeting psychological support to the needs of different groups may be an important step toward improving mental health services. For example, variation in demographic factors, such as age, may affect the type of mental health support needed. A child's level of adjustment to cancer diagnosis and treatment may be closely related to parental adjustment and coping[5]. This demonstrates the strong role that family plays in children's mental health support. Young adults with cancer may have a unique set of concerns related to relationships, fertility, and financial security that are not shared by other age groups[6]. Meanwhile, older adults may worry more about recurrence and developing a secondary primary cancer[7]. It is obvious that the psychological cancer experience varies at different points in life; this necessitates varied and targeted mental health support that should be ongoing and integrated as part of a regular treatment and post-treatment schedule.

A significant barrier to the provision of mental health support services for individuals with cancer may be issues with coordinated care. Cancer is now likened to a chronic illness, with survivors experiencing mental and physical effects that require short- and long-term management both during and after treatment. As with chronic illnesses, the coordination and delivery of care across multiple disciplines are imperative to fulfilling the needs of cancer patients. While social workers and psychologists are part of a hospital healthcare team, their counsel may not be sought as often as it should, perhaps due to a lack of referral to these professionals by the consulting oncologist. Physicians frequently focus on the physiological effects as opposed to psychosocial

that patients often have to endure[8], while patients typically only report what is asked of them or what they believe is more important to their physician[9]. Without appropriately gauging the mental health support needed, oncologists may be under-referring their patients to counselling services. Unless a patient exhibits health-seeking behaviours, it is unlikely that they would self-refer to available services provided by the health care centre. As such, in addition to services that are typically offered to patients (e.g. fertility specialists, dentistry and pain clinics), oncologists should offer mental health services to all of their patients as part of their practice.

Potential contributions to psychological support services for individuals with cancer are collaborative support groups held outside of clinical time. These groups, facilitated by oncologists, social workers and psychologists, can provide multi-levels of support. With practitioners from both psychosocial and medical disciplines present at each meeting, and with the addition of peer guidance, these types of groups enable patients to engage in dialogue regarding both physical health and mental coping outside of the clinic, allowing for more robust discussion and greater levels of support. Collaborative groups that are specific to different age groups would be additionally beneficial. Furthermore, support services should be extended to family, as family members may feel depression and anxiety at levels equal to that of the patient [10]. While barriers such as clinician time and organizational resources may limit the implementation of such groups, the benefits of creating collaborative out-of-clinic mental health services warrant further research and consideration.

Psycho-oncology is a burgeoning field and the long-term effects of cancer are now beginning to be understood. Given the improvements in recent years to the medical care and survival of cancer patients, it is only logical that the provision of appropriate mental health services should be ameliorated to support patients during treatment and throughout their lives.

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Main Submission

Lost In Transition: A young adult cancer survivor's perspective on life after cancer

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Introduction – Fitting Into An Unfamiliar Place

From a patient's perspective, cancer is not only a physical illness. The emotional toll incurred upon diagnosis can be just as devastating and is often overlooked. As a cancer survivor, I know that for young adults this emotional hardship could not come at a worse time. A common theme of all young adults is the transitional nature of our lives. This transition represents moving from the security of adolescence to the independent development of careers and families.[1] This development produces a fast-paced lifestyle that if interrupted by a cancer diagnosis creates a void between this fast-paced life and a stalled cancer life. For example, my diagnosis came before I was supposed to start university and led to me missing my first semester. Seven years later, upon completion of my treatment and with the expectation of regaining my former life, I soon discovered that re-integration into a "cancer-free" life was incredibly difficult. Previous work has shown that the inability to re-integrate can initiate feelings of isolation, anxiety, decreased self-esteem and depression which may be long-lasting without the proper support.[2] An apparent flaw in our healthcare system is the lack of emotional support for this post-treatment barrier, forcing young adults to fight this battle alone. Due to my personal struggle with cancer, this article will focus on firsthand experiences with life after cancer, and where improvements are needed.

Isolation – A Two Hit Mechanism

Upon completing treatment and trying to re-integrate into my "old" life, the psychological struggle that was most difficult was overcoming social isolation. This isolation is one of the most devastating and yet understudied emotional trials for young adult cancer patients.[3] In my opinion, this trial has the following origins: Firstly, a catalyst for isolation during treatment is navigating a medical system generally designed for a much older patient population.[2][4] For example, the cancer centre where I was treated had an overwhelmingly older patient demographic with no form of peer-support tailored to young adults. It was a strange feeling to walk into a world renowned cancer centre and be one of the youngest people there by a minimum of thirty years. Although unacceptable, this is the standard throughout Canada, with only five centres having peer-support geared-towards young adults.[5]

Secondly, another origin of isolation comes post-treatment and is initiated by the inability to re-integrate into a "cancer-free" life. Due to my physical appearance and emotional instability, it was difficult to converse on a normal level with my peers which segregated me based on my disease instead of my age. This second origin of isolation compounded the first as the inability to converse with my peers affected personal relationships and academic endeavors, further preventing re-integration. Although it would seem that isolation would dissipate with time, the emotional long-term effects can influence patients well after their treatment has finished.[6] As young adults have their entire lives ahead of them, emotional support networks need to be implemented to attenuate long term emotional damage due to isolation.

Healthcare Program Implementation – What can we do?

Based on the psychosocial challenges young adult patients face and the corresponding long term effects, it is critical that novel health care policies encompass these patient's post-treatment needs. Upon completing treatment, it was left up to me to go and find the support I needed which took strenuous searching to come up with the proper support. Finding the appropriate organizations is a very difficult task for survivors who, after finishing treatment, are fatigued or physically

unable to make this commitment. In my opinion, this situation is unacceptable. Implementing young adult tailored support groups as part of post-treatment care should be mandatory and should be incorporated into all major centres. A way of supplementing a costly professionally-led system is to use a peer-led support system which has been shown to have few qualitative differences. [7] By facilitating young adult survivors to create these groups, it allows both emotional support and encourages the formation of communities or "cancer families" which could further reduce the feeling of isolation.[8] In either case, using professionally-led or peer-led support groups increases support for young adults which attenuates feelings of isolation and long-term associated distress.

Conclusions – What is the next step?

For the young adult cancer patient, the re-integration into a life after cancer is incredibly difficult. There is a significant need to create support systems to help bridge the young adult survivor's cancer life to their new "cancer-free" life. Healthcare support programs specific to young adults need to be placed in all major cancer centres throughout Canada. Only when these support systems are nationally accessible can we effectively help all young adult's psychological needs. By removing the onus of young adults to find their own support systems, their focus can shift from surviving to thriving.

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