





# The UBCMJ Thanks Pollock Clinics For Their Generous Support



No-Scalpel No-Needle Vasectomy  
Infant Circumcision

Offices in Vancouver and  
New Westminister

**604-717-6200**

[www.pollockclinics.com](http://www.pollockclinics.com)

[www.circumcisionvancouver.com](http://www.circumcisionvancouver.com)



## EDITORIAL

- Crossing Bridges: An Interprofessional Perspective 7  
*Shifana Lalani, Nicolas Bilbey*

## FEATURE

- The Power of Healthy Collaborations from Here 8  
*Stephen Toope*
- Interprofessional Education for Interprofessional Practice: Will Future Health Care Providers Embrace Collaboration as One Answer to Improved Quality of Care? 9  
*Lesley Bainbridge*

## ACADEMICS

- Examining the Association Between Insomnia and Bowel Disorders in Canada: Is There a Trend? 11  
*Chun-Yip Hon, Anne-Marie Nicol*

## REVIEWS

- Permanent Childhood Hearing Impairment and the Universal Newborn Hearing Screening Program in British Columbia 16  
*Renée M. Janssen*
- Diabetes in South Asians: Etiology and the Complexities of Care 20  
*Anish R. Mitra, Irvin Janjua*
- Treatment Modalities and the Neuropathology of Palmar Hyperhidrosis 24  
*Mark S. Ballard, G.R. Wayne Moore, Thomas J. Zwimpfer*

## GLOBAL HEALTH

- Electronic Wastelands: Decomposing Computers and Communities Around the World 30  
*Kiran A. Massey, Jordan Eunson*
- A Tale of Two Tiers: Inequality in South Africa's Health Care System 33  
*Andrea Human*

## NEWS AND LETTERS

- Vancouver Home to Canada's First Multidisciplinary Vulvodynia Program 34  
*Ranita H. Manocha*
- Dr. S. Larry Goldenberg Receives the Order of Canada 35  
*Simon Jones*
- UBC Goes Southern 35  
*Jay Joseph*
- Full of Love, and Hope and the Colour Red, Your Girl, Eva 37  
*Simon Jones*
- UBCMJ Congratulates Mr. Michael Suen, Winner of the Pollock Clinics Distinguished Writing Award for Issue 1.2: Global Health 38  
*UBCMJ Staff*

## COMMENTARIES

- An Innovative Model for Interprofessional Education and Practice: A Student-Run Interprofessional Rehabilitation Medicine Clinic 39  
*Sepehr Khorasani, Tonia Berg, Mohammadali Khorasani, Sabrina Kolker*
- Medicare in BC: Choosing an Evidence-Based Future 42  
*Rupinder Brar, Matthew Cooper, Spencer Cleave, Persia Pourshahnazari*

## CAREERS

- Seven Questions with Dr. David Naylor, President of the University of Toronto 44  
*UBCMJ Staff*

## CASE AND ELECTIVE REPORTS

- Case Study: Management of Post-Parotidectomy Neuropathic Pain with Tetrahydrocannabinol:cannabidiol (Sativex) 45  
*Patrick T. Yang, May Ong-Lam*

### On the cover

Corpus Collagesome by Lindsay Stokvis, Vancouver Fraser Medical Program 2012.

This piece was Lindsay's entry in the UBC Neuro Visual Arts Contest: Making Connections. To see more images from this contest, please refer to page 49.

# UBCMJ IS NOW ONLINE!

VISIT [www.ubcmj.com](http://www.ubcmj.com)

## FEATURES

ONLINE ARTICLE SUBMISSIONS  
CURRENT + PAST DOWNLOADABLE ISSUES  
LATEST UPDATES FOR NEWS + EVENTS  
CONTACT INFORMATION

The screenshot shows the UBCMJ website homepage. At the top, there is a navigation bar with links for HOME PAGE, NEWS & EVENTS, CURRENT ISSUE, ALL ISSUES, ABOUT UBCMJ, SUBMISSIONS, RESOURCES, and CONTACT US. The main content area features a welcome message: "Welcome to UBCMJ. We are a student-run academic journal with a goal to engage students in dialogue in medicine. [Learn more »](#)". Below this, a banner states: "We are now accepting submissions for our next issue, UBCMJ Volume 2 Issue 2: Rural Medicine. [Submit an article »](#)". The page is divided into two columns. The left column displays the cover of "UBCMJ Volume 1, Issue 2" dated March 30, 2010, with a "Presenting our newest section: GLOBAL HEALTH" banner. The right column, titled "Latest articles", lists three articles: "Diagnosing the Obama Plan" by Karan Singh Grewal (188 KB), "Lessons from the Travelling Patient" by Wesley Jang (115 KB), and "Clinical Vignette: Splenic Abscesses" by Sandra Jennesson et al. (1,800 KB). Each article includes a "Download article" link. At the bottom of the right column, there is a link to "See more articles from our current issue »".

UBC Medical Journal  
2750 Heather Street  
Vancouver, BC  
V5Z 4M2

By Students, For the World

## INTERNAL TEAM

<b>Editor in Chief</b>	Diane Wu
<b>Editor in Chief Assistant</b>	Shifana Lalani
<b>Managing Editors, Sr</b>	David Tso David Youssef
<b>Managing Editors, Jr</b>	Christopher Cheung Kiley Cindrich
<b>Director of Publications, Sr</b>	Jennifer Tam
<b>Director of Publications, Jr</b>	Nina He
<b>Layout Editor, Sr</b>	Kelvin Kwan
<b>Layout Editor, Jr</b>	Freda Wong
<b>Academic Editor, Sr</b>	Jacqueline Ngai
<b>Academic Editor, Jr</b>	Tyler Hickey
<b>Case &amp; Electives Editor, Sr</b>	Jonathan Chi
<b>Case &amp; Electives Editor, Jr</b>	William Lau
<b>Commentaries Editor, Sr</b>	Julius Elefante
<b>Commentaries Editor, Jr</b>	Goldis Chami
<b>Global Health Editor, Sr</b>	Naila Karim
<b>Global Health Editor, Jr</b>	Samuel Wasswa-Kintu
<b>News &amp; Letters Editor, Sr</b>	Long Nguyen
<b>News &amp; Letters Editor, Jr</b>	Ida Molavi
<b>Reviews Editor, Sr</b>	Clara Westwell-Roper
<b>Reviews Editor, Jr</b>	Maryam Dosani
<b>Copy Editors</b>	Joanna Si Bez Toosi Pretty Verma
<b>Legal Consultants</b>	Audrey Lim Joanna Si
<b>Staff Writers</b>	Ranita Manocha Simon Jones Jay Joseph

## EXTERNAL TEAM

<b>Editor in Chief</b>	Pamela Verma
<b>Editor in Chief Assistant</b>	Nicolas Bilbey
<b>Director of Advertising &amp; Sponsorships</b>	Corey Colville
<b>Director of Promotions</b>	Ciara Chamberlain
<b>Communications Manager</b>	Aaron Gropper
<b>Sponsorship Managers</b>	Alison Lee Jennifer Yam Dimas Yusuf
<b>Information Technology Manager</b>	
<b>Subscription Managers</b>	Godfrey Lam Yashar Tashakkor Kevin Lowe
<b>Advertising Manager</b>	
<b>Business Advisor</b>	James Liao
<b>Events Coordinator</b>	Jae Won Choi
<b>Academic Liaison</b>	Tanya Griffiths
<b>Treasurer</b>	Lauren Lee
<b>Residency Representative</b>	Ananta Gurung
<b>Graduate Student Representative</b>	Connie Lee
<b>NMP Site Representative</b>	Gavin Tansley
<b>IMP Site Representative</b>	Suzana Mitrovic
<b>Year 3 &amp; 4 Representative</b>	Mike Rivers-Bowerman

## BRANDING ADVISORY TEAM

<b>Professional Consultant</b>	Alison Liebel
<b>Communications Designer</b>	Connie Sze
<b>Branding Consultant</b>	Magalie Kolker
<b>Communications Consultant</b>	Melanie Perez

<b>Faculty Reviewers</b>	Dr. Nigel Ball Dr. Charles Bernstein Dr. Tom Elliott Dr. Michael Klein Dr. Kevin McElwee Dr. Anton Miller Dr. Louise Nasmith Dr. Jill Osborn	Dr. Breay W. Paty Dr. Tom Pickles Dr. Diane Sawchuck Dr. Susan Anne Small Dr. Judith Soon Dr. Stephen Yip Dr. Jeffrey Zaltzman
<b>Student Reviewers</b>	Azadeh Arjmandi David Harriman Renée Janssen Amber Jarvie Helen Jiang Luvdeep Malhi Ranita Manocha	Colin McInnes Steven Rathegeber Peter Rose Serena Siow Jennifer Smitten Dr. Heather Stuart Shazeen Suleman

**The UBCMJ could not have been possible without the valuable support and guidance of the following:**

- |                         |                                      |
|-------------------------|--------------------------------------|
| Dr. Oscar Casiro        | Mr. Rue Ramirez                      |
| Dr. John R. G. Challis  | Dr. Sharon Salloum                   |
| Mr. Jay Draper          | Dr. David Snadden                    |
| Ms. Carri Folk          | Mr. Robert Stibravy                  |
| Dr. David Hardwick      | Dr. Gavin Stuart                     |
| Dr. Cheryl Holmes       | Ms. Kashmira Suraliwalla             |
| Dr. S. Larry Goldenberg | Dr. Alexandra Tcheremenska-Greenhill |
| Mr. Dean Guistini       | Dr. Sydney Thomson                   |
| Ms. Lindsay Lynch       | Ms. Nancy Thompson                   |
| Mr. Cyrus McEachern     | Dr. Angela Towle                     |
| Dr. David Naylor        | Ms. Daniella Webber                  |
| Mr. Daniel Presnell     |                                      |

**We would like to thank our printing house Counter Clockwise Design & Production Group for their generous support.**

The *UBC Medical Journal* uses an open access publishing policy in line with our mandate to publish in a socially responsible way. We endorse open access publishing as the preferred model for scholarly communication and encourage the adoption of open access principles by universities and research agencies.

To subscribe, advertise or submit, see our website.

**Website:** [www.ubcmj.com](http://www.ubcmj.com)

**Mailing Address:**  
*UBC Medical Journal*  
 2750 Heather Street  
 Vancouver, BC  
 V5Z 4M2

**DISCLAIMER:** Please note that views expressed in the *UBCMJ* do not necessarily reflect the views of the editors or the Faculty of Medicine or any organizations affiliated with this publication. They are solely the authors' opinion and are intended to stimulate academic dialogue.

# Crossing Bridges: An Interprofessional Perspective

Shifana Lalani, BSc (Hons), MSc<sup>a</sup>, Nicolas Bilbey, BSc, MSc<sup>a</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2013, Faculty of Medicine, University of British Columbia, Vancouver, BC

One year ago, the *University of British Columbia Medical Journal (UBCMJ)* made history and launched the first issue of its now reborn medical journal. Diane Wu and Pamela Verma, the founders of the *UBCMJ*, believed medical students should have an academic platform to express their research and ideas. They also wanted to facilitate a learning process to publish academic articles that would be available for medical students. Since that time, the *UBCMJ* has grown well beyond any expectations. As the new Editors-in-Chief, we would like to continue the initial vision of the journal as an academic platform of communication and also expand the journal to reach individuals in all areas of medicine.

Medicine itself represents a network of individuals, from various fields, able to work together for a common goal. For the third issue of the *UBCMJ*, we hope to facilitate communication from an interdisciplinary perspective. Interprofessional education (IPE) originated due to parallel initiatives between social work and nursing in the United Kingdom during the 1960s.<sup>1</sup> Since that time, IPE has been the cornerstone of many health initiatives led by the World Health Organization.<sup>2</sup> The Center for the Advanced Placement of Interprofessional Education in London has become the focal point of IPE research around the world.<sup>1,3,4</sup> Still, more evidence is needed to prove IPE will benefit both the students and patients involved.<sup>5</sup> Current studies suggest IPE may be the solution for inappropriate communication between health professionals for patient care management.<sup>3</sup>

Despite the lack of substantial research, university faculties across the country have begun to embrace IPE and change the curriculum to encourage health professionals and students to collaborate and work together. Stephen Toope, president of the University of British Columbia (UBC), and Lesley Bainbridge, the Director of Interprofessional Education at UBC, have discussed this topic and key concepts relating to the positive and negative implications of creating an interprofessional mindset within university education (Toope pg. 8, Bainbridge pg. 9).

IPE departments in Toronto, McGill, and numerous other Canadian universities have also introduced new initiatives to be developed and implemented within the undergraduate and graduate health care education.<sup>6-7</sup> Barriers in funding, scheduling within

the curricula, and lack of educators may impede the process,<sup>8</sup> but with drive and determination, education connecting all aspects of health care may become a reality. To this extent, student-run clinics facilitating an interprofessional environment have been implemented in other provinces in Canada, and such programs in British Columbia are discussed in this issue (Khorasani *et al.* pg. 39).

Interprofessionalism also provides a possible solution to a system with limited resources and rising health care costs. As the global economy has faced recession, it is important to consider how health care resources will be impacted, especially with respect to structure and organization. The public versus private health care debate has been at the forefront of discussion, in an effort to determine the most efficient health care structure (see Brar *et al.* pg. 42).

As the *UBCMJ* expands, we hope to continue to facilitate communication within medicine and other aspects of health care. Providing a platform for academic discourse will allow future and past generations of students and faculty to both learn and contribute to their academic environments.

## REFERENCES

1. Barr H. *Interprofessional Education Today, Tomorrow, and Yesterday*. Revised edition, June 2005. London, UK: Higher Education Academy, Health Sciences and Practice Network.
2. Oandasan I, Reeves S. Key elements for interprofessional education. Part 1: the learner, the educator and the learning context. *J Interprof Care*. 2005 May;19 Suppl 1:21-38.
3. Barr H, Hammick M, Koppel I, Reeves S. Evaluating Interprofessional Education: two systematic reviews for health and social care. *Brit Educ Res J*. 1999 Sep;25(4):533-544.
4. Centre For The Advancement Of Interprofessional Education [homepage on the Internet]. London: CAIPE; c2010 [updated 2010 July 30; cited 2010 Aug 7]. Available from: <http://www.caipe.org.uk/>.
5. Reeves S, Zwarenstein M, Goldman J, Barr H, Freeth D, Koppel I, Hammick M. The effectiveness of interprofessional education: Key findings from a new systematic review. *J Interprof Care*. 2010 May;24(3):230-241.
6. The McGill Educational Initiative on Interprofessional Collaboration [homepage on the Internet]. Montreal: McGill University; [cited 2010 Aug 7]. Available from: <http://www.interprofessionalcare.mcgill.ca/default.htm>.
7. The University of Toronto Centre for Interprofessional Education [homepage on the Internet]. Toronto: University of Toronto; c2006-2008 [updated 2009 Dec 5; cited 2010 Aug 7]. Available from: <http://www.ipe.utoronto.ca/>.
8. Steinhert Y. Learning together to teach together: Interprofessional education and faculty development. *J Interprof Care*. 2005 May;19 Suppl 1:60-75.

## Correspondence

Shifana Lalani, [internal.editor@ubcmj.com](mailto:internal.editor@ubcmj.com) or  
Nicolas Bilbey, [external.editor@ubcmj.com](mailto:external.editor@ubcmj.com)

# The Power of Healthy Collaborations from Here

Stephen Toope, PhD, LLB, BCL, MA<sup>a</sup>

<sup>a</sup>President and Vice-Chancellor, University of British Columbia, Vancouver, BC

*"In the long history of human kind (and animal kind too) those who learned to collaborate and improvise most effectively have prevailed."* – Charles Darwin

The imperative of Darwin's observation is becoming all the more apparent in the world of health care, beset as it is by global, regional and local challenges. Whether the focus is research, education, or clinical care, collaboration is a crucial operating principle within our Faculty of Medicine. Today's medical challenges range from unraveling the mysteries of brain functions, to delving into molecular markers for breast cancer, or establishing a global protocol to fight AIDS/HIV. Today's teams of scientists, clinicians, and technicians at the University of British Columbia (UBC), our partner institutions, and global colleagues devote years of their lives and are fuelled by curiosity and determination to find solutions to problems faced by humanity. That collaboration helps explain why 49% of all of the research funds (\$475.3 million) spent at UBC in 2008-2009 were generated by teams within the UBC Faculty of Medicine.

Within the Faculty of Medicine, best known for educating physicians, other health care students in physical therapy, occupational therapy, speech language pathology, audiology, public health, and basic sciences are also being trained. This diversity of disciplines provides fertile ground for the expansion of another example of collaboration: interprofessional education. For example, the faculty's current curriculum renewal process for undergraduate medical education is placing a significant emphasis on the growing importance of bringing disciplines together with the patient or client as the central focus. This direction is further supported by a recent report entitled "The Future of Medical Education in Canada" by the Association of Faculties of Medicine of Canada.<sup>1</sup> In addition, provincial and federal policy directives increasingly focus on the use of interdisciplinary teams to facilitate effective health care in times of health care resource challenges.

A successful example of interprofessional collaborative education can be seen in the Interprofessional Rural Program of BC where, over the past six years, students from 13 disciplines (many from UBC) have worked in 11 communities including Bella Coola, Trail, Port McNeill, and Ladysmith.

#### Correspondence

Stephen Toope c/o Patricia Stevens, patricia.stevens@ubc.ca



In this photo: Professor Stephen Toope

Another aspect of collaboration is the distributed medical program that takes place with our partners at the University of Victoria, the University of Northern British Columbia, and soon with UBC's own Okanagan campus. The tangible and positive impact of this co-operative venture, which was launched in 2004 with strong support from the provincial government, can now be seen by the fact that the number of graduating physicians has almost doubled from 119 in 2001 to 216 in 2009. It is expected that some recent graduates will choose to establish their practices in rural and smaller urban centres.

Sixty years beyond the beginning of our Faculty of Medicine, collaborations with health providers continue to multiply. Every day, student physicians are being taught in clinical settings belonging to one of BC's six health authorities – from Kamloops to Castlegar, from Surrey to Fort St. John – all focused on helping patients and clients remain healthy. In New Westminster, a student-run community physical therapy clinic is helping clients with mobility. In Prince George and Vancouver, one of UBC's epidemiologists is working with First Nations leaders on AIDS issues.

These examples of collaborative partnerships, and many others, are ubiquitous enough to prove that the Faculty of Medicine is not just a series of places joined by robust, innovative communication technology. It is a community of people acting as catalysts, wherever they are located, to teach, learn, discover, and serve the vision of the faculty through knowledge and perseverance. 

“

**Whether the focus is research, education or clinical care, collaboration is a crucial operating principle within our Faculty of Medicine.**

#### REFERENCES

1. Association of Faculties of Medicine of Canada. The Future Medical Education in Canada (FMEC): A Collective Vision for MD Education [document on the Internet]. Ottawa: AFMC; 2010 [cited 2010 Aug 5]. Available from: [http://www.afmc.ca/fmec/pdf/collective\\_vision.pdf](http://www.afmc.ca/fmec/pdf/collective_vision.pdf).

# Interprofessional Education for Interprofessional Practice: Will Future Health Care Providers Embrace Collaboration as One Answer to Improved Quality of Care?

Lesley Bainbridge, BSR(PT), MEd, PhD<sup>a,b</sup>

<sup>a</sup>Director, Interprofessional Education, Faculty of Medicine, University of British Columbia, Vancouver, BC

<sup>b</sup>Associate Principal, College of Health Disciplines, University of British Columbia, Vancouver, BC

## ABSTRACT

Interprofessional education is an emerging theme in the education of health care professionals in response to issues such as patient safety and workforce shortages. Future health care providers must learn how to collaborate effectively with other professionals to reduce errors and improve recruitment and retention. Health care in Canada is changing in an attempt to reduce costs and increase efficiencies, and interprofessional practice is now a priority. While barriers to interprofessional education do exist, there is a growing body of knowledge that supports interprofessional collaboration as best practice. More research is required, but there is enough evidence to suggest that interprofessional education is a current imperative.

A few years ago Esther, a 77-year-old healthy, active woman, was admitted to a British Columbia hospital for elective surgery.<sup>1</sup> Two weeks later she passed away. The coroner as well as the professional and health authority investigators all concluded Esther passed away due to, in large part, lack of communication between and among her health care providers.

A University of British Columbia report in 1968 highlighted the importance of interprofessional education (IPE), the need for all health professionals to collaborate effectively, and the urgency of developing educational strategies to promote interprofessional learning.<sup>2</sup> Forty years later, IPE has experienced little development at a time when the health care field is experiencing significant issues: health care costs continue to rise and funding continues to erode; the first wave of aging boomers has arrived; primary health care and chronic disease management are the emerging and important foci for health services; an existing worldwide shortage of health care providers continues to grow; and technology is revolutionizing the way we communicate in healthcare.<sup>3,4</sup> In short, the world of health care is rapidly changing. One of the major areas in which service delivery will change is collaborative practice – health care providers communicating and collaborating more consistently and more effectively.<sup>5</sup>

IPE in health is described as a way of educating collaborative health care providers.<sup>6</sup> The impetus for IPE emerges from concerns such as patient safety. Reports such as “To Err is Human”, “Crossing the Quality Chasm”, and “The Canadian Adverse Events Study” all suggest that we harm patients, often seriously, if we do not communicate and collaborate both within and among professions.<sup>6-8</sup> To ensure that future generations of health care providers collaborate effectively, we need to introduce opportunities for those in the health professions to “learn with, from, and about each other” from the time they enter their professional education programs through to continuing professional development.<sup>9</sup> This may be the most effective way to influence future practice.

Barriers to IPE are many and are common across all health professions.<sup>10</sup> With respect to education, these include a lack of flexibility in the scheduling of curricular activities; the challenges of finding space to bring groups of students together; the costs required for team teaching; the complexity of assessing students’ performance in team-based settings; and a lack of interprofessional placements in the community. In the

“

...we need to introduce opportunities for those in the health professions to “learn with, from, and about each other”...

## Correspondence

Lesley Bainbridge, lesleyb@interchange.ubc.ca

practice setting, the barriers include the lack of the following: funding to create the organizational changes required to support collaborative or team-based care; institutional support for a collaborative practice model; time; incentives to reinforce best practices in collaboration; and attention to teaching and learning collaborative practice skills as part of continuing professional development. However, as service delivery is redesigned, especially in areas such as primary health care, a rapidly emerging menu of IPE strategies and approaches is demonstrating positive changes in the attitudes, knowledge, skills, and behaviours of both students and practitioners. These strategies have several characteristics in common. They focus the learner's attention on patients and families and offer learning experiences in clinically relevant and interesting areas.<sup>11</sup> They offer interactive and experiential learning, and they allow time for learners to reflect on their ability to collaborate effectively.<sup>11</sup> Examples of effective interprofessional learning include student-run clinics, portfolios, team-based rural placements, health care team challenges, joint assessments of patients with complex conditions, and interprofessional problem-based learning sessions. Among educators and practitioners, there are those who believe without reservations that collaboration is the way of the future, those who do believe but are concerned that we still do not understand interprofessional education and practice fully, and those who do not see a need to change from historical and isolated patterns of practice and resist the change. Those in the latter two groups claim a lack of evidence that team-based care or collaboration generally is effective. However, there is emerging and robust evidence that interprofessional collaboration does improve patient safety and quality of care as well as improve issues such as recruitment and retention. A 2010 World Health Organization publication clearly summarizes evidence that: interprofessional education and practice improve access to care and health outcomes especially for those with a chronic condition; reduce hospital admissions and lengths of stay; and improve mental health outcomes and end of life care.<sup>12</sup> A recent Canadian Institutes of Health Research (CIHR) funded study found clear evidence in the peer-reviewed and grey literature that interprofessional collaboration positively impacts health human resources.<sup>13</sup> Admittedly we need more robust research on IPE and collaborative practice, but there is enough evidence now to support a heavy emphasis on IPE for both students and practitioners to create a collaborative workforce for the future.

We are slowly beginning to understand what interprofessional collaboration requires. The Canadian Interprofessional Health Collaborative has just recently posted a national competency framework for interprofessional collaboration.<sup>14</sup> The framework provides an example of a model collaborative practitioner which can help us to understand what kind of experiences will help students and practitioners learn how to collaborate more effectively. In addition to this framework, a Health Canada funded project, Accreditation of Interprofessional Health Education, is moving ahead to develop accreditation standards for IPE in education programs for medicine, nursing, pharmacy, physical therapy, occupational therapy, and social work.<sup>15</sup> The Future of Medical Education in Canada report

explicitly notes interdisciplinary learning and practice as crucial to medical curricula.<sup>16</sup> Increased attention is now focusing on IPE and collaborative practice as key components of a health professional's education.

IPE may be one of our most valuable tools for training collaborative practitioners, and improved collaborative practice may be one of the most effective responses to rising health care costs and increasingly complex health care needs. Across Canada and around the world, educators and practitioners are working to improve IPE teaching methods so that new generations of health care providers will embrace collaboration as one of the best ways to improve quality of care and patient safety. 

## REFERENCES

1. Szaz G. Interprofessional Education in the Health Sciences: A Project Conducted at the University of British Columbia. *The Milbank Mem Fund Quart.* 1969;47(4) : 449-75.
2. Canadian Institute for Health Information. *Health care in Canada 2009: a decade in review.* Ottawa: CIHI; 2009.
3. World Health Organization. *Learning together to work together for health: report of a WHO study group on multiprofessional education for health personnel: the team approach.* Technical Report Series 769. Geneva: The Organization; 1988. p. 1-72.
4. Romanow RJ. *Building on values; the future of health care in Canada.* Saskatoon: Commission on the Future of Health Care in Canada; 2002.
5. Hammick M, Freeth D, Koppel I, Reeves S, Barr H. A best evidence systematic review of interprofessional education: BEME Guide no. 9. *Med Teach* 2007;29(8) : 735-51.
6. Kohn LT, Corrigan JM, Donaldson MS, editors. *To err is human: building a safer health system.* Washington DC : National Academic Press; 2000.
7. Corrigan JM. *Crossing the quality chasm: a new health system for the 21st century.* Washington DC: Institute of Medicine; 2001.
8. Baker GR, Norton PG, Flintoft V, Blais R, Brown A., Cox J, *et al.* The incidence of adverse events among patients in Canada. *Can Med Assoc J.* 2004;170(11):1678-85.
9. Centre for the Advancement of Interprofessional Education. *Defining IPE.* London: CAIPE; 2001 [cited 2008 Aug 6] Available from: <http://www.caipe.org.uk/about-us/defining-ipe/?keywords=principles>.
10. Gilbert J. Interprofessional learning and higher education structural barriers. *J Interprof Care.* 2005;19 Suppl 1:87-106.
11. D'Eon M. A blueprint for interprofessional learning. *J Interprof Care.* 2005;19 Suppl 1:49-59.
12. World Health Organization. *Framework for action on interprofessional education & collaborative practice.* Geneva: The Organization; 2010.
13. Suter E. and Deutchlander S. *Can interprofessional collaboration provide health human resources solutions?* Ottawa: Canadian Institute of Health Research; 2010.
14. Canadian Interprofessional Health Collaborative. *A national competency framework for interprofessional collaboration [document on the Internet].* Vancouver: CIHC; 2010 [cited 2010 May 8] Available from: [http://www.cihc.ca/files/CIHC\\_IPCompetencies\\_Feb1210.pdf](http://www.cihc.ca/files/CIHC_IPCompetencies_Feb1210.pdf).
15. Association of Faculties of Medicine of Canada. *Accreditation of Interprofessional Health Education (AIPHE): Principles and practices for integrating interprofessional education into the accreditation standards for six health professions in Canada [document on the Internet].* Ottawa: AFMC; 2009 [cited 2010 May 14] Available from: <http://www.afmc.ca/aiphe-afiss/home.html>.
16. Association of Faculties of Medicine of Canada. *The future of medical education in Canada [document on the Internet].* Ottawa, AFMC; 2010 [cited 2010 May 14] Available from: [http://www.afmc.ca/fmec/pdf/collective\\_vision.pdf](http://www.afmc.ca/fmec/pdf/collective_vision.pdf).

# Examining the Association Between Insomnia and Bowel Disorders in Canada: Is There a Trend?

Chun-Yip Hon, MSc(A), CRSP, CIH<sup>a</sup>, Anne-Marie Nicol, PhD<sup>a,b</sup>

<sup>a</sup>School of Environmental Health, University of British Columbia, Vancouver, BC

<sup>b</sup>Centre for Health & Environment Research, University of British Columbia, Vancouver, BC

## ABSTRACT

**OBJECTIVE:** Sleep is critical for one's health and well-being, including the prevention and/or management of certain chronic health conditions. If one suffers from insomnia (trouble falling asleep or staying asleep), he/she may be at risk of developing bowel disorders such as irritable bowel syndrome. To our knowledge, there is little information in Canada linking insomnia to bowel disorders. Our goal was to employ a population-based study to ascertain the association between insomnia and bowel disorders as well as to determine if a trend exists in the relationship.

**METHODS:** The data originated from the Canadian Community Health Survey Cycle 1.1. The outcome variable was whether an individual has a bowel disorder (yes/no response). The primary explanatory variable was individuals who reported having trouble sleeping most of the time (insomnia). Odds ratios were calculated to determine the association of suffering from a bowel disorder if one has insomnia.

**RESULTS:** We found there was a strong relationship between insomnia and bowel disorders (unadjusted odds ratio 3.73; 95% CI: 3.37 to 4.12). This association remained statistically significant (adjusted odds ratio 2.79; 95% CI: 2.51 to 3.10) even when adjusted for sex, age, self-perceived stress and the presence of chronic fatigue syndrome in our multivariate logistic regression model. We demonstrated a stepwise trend such that an increase in frequency of trouble sleeping was associated with a greater incidence of bowel disorder.

**CONCLUSION:** We found a strong association between insomnia and the likelihood of suffering from a bowel disorder in the Canadian population.

**KEYWORDS:** *insomnia, bowel disorders, Canadian Community Health Survey (CCHS), Crohn's disease, irritable bowel syndrome*

## INTRODUCTION

Sleep is vital from both a physical and psychological perspective. However, some individuals chronically suffer from poor quality of sleep. Insomnia, defined in laymen's terms as trouble falling asleep or staying asleep, affected nearly a quarter of the Canadian population aged 15 and older in a 1991 study.<sup>1,2</sup> A recent North American study suggests that the current prevalence of insomnia may be as high as 40% and that this level is likely to increase in the future.<sup>3</sup> A person with insomnia experiences reduced daily functioning and suffers from psychomotor impairment, which adversely affects both personal and professional activities.<sup>4</sup> It is also hypothesized that insomnia is a contributing factor in the development of various adverse health outcomes. Bowel disorders, such as Crohn's disease and irritable

bowel syndrome (IBS), are believed to be partially caused by insomnia due to disruptions to the autonomic nervous system.<sup>5,6</sup> Both Crohn's disease and IBS are chronic bowel disorders that can cause severe and disabling abdominal pain. With respect to Crohn's disease among Canadians, recent evidence suggests the incidence rate and prevalence are 13.4/100,000 and 233.7/100,000 respectively, reflecting some of the highest figures in the world.<sup>7</sup> According to Thompson *et al.*,<sup>8</sup> 12.1% of Canadians suffer from IBS. As a result, the estimated annual cost of IBS to Canada is almost \$1.4 billion, which includes both direct and indirect costs.<sup>9</sup> This approximation is even more disturbing given there is currently no cure for either disease.

Our review of the literature suggests although there is evidence linking insomnia with bowel disorders, it is relatively limited. Goldsmith and Levin were the first to find that sleep deprivation among healthy volunteers elicited irritable bowel-like symptoms.<sup>10</sup> However, with only 23 subjects, drawing

### Correspondence

Chun-Yip Hon, cyhon1@interchange.ubc.ca

“

**...insomnia is a contributing factor in the development of various adverse health outcomes.**

generalizations from their results is restricted. In their study consisting only of women, Jarrett *et al.*<sup>11</sup> concluded that poor sleep leads to more reported gastrointestinal symptoms, even when controlling for psychological distress and stress. Working shifts has also been shown to affect sleep patterns – the level of sleep disturbance has been likened to that of clinical insomnia.<sup>12</sup> Not surprisingly, nurses who worked rotating shifts were found to experience more functional bowel disorders than those who worked non-rotating shifts.<sup>13</sup> However, the study was limited by a small sample size and examined a specific cohort of workers, which is not necessarily representative of the general population. To our knowledge, there are only two population-based studies available on the topic of insomnia and its relationship to bowel disorders. In one study, the authors found a positive and statistically significant association between sleep disturbance and IBS (OR 1.6; 95% CI: 1.1 to 2.2).<sup>14</sup> In a follow-up study involving the same cohort, the authors found as sleep disturbances increased, so did the frequency of reported gastrointestinal symptoms.<sup>15</sup> However, both these studies were restricted to a small county in Minnesota, therefore limiting their external validity.

Given the burden of bowel disorders in Canada as well as the dearth of information on this matter, we conducted an investigation to test the hypothesis that insomnia increases the likelihood of suffering from bowel disorders among Canadians. To our knowledge, a population-based study examining such an association has not been conducted in Canada. The objectives of our study are to: 1) determine the prevalence of both insomnia and bowel disorders in Canada using a recent health survey database; 2) identify the characteristics of those who have self-reported bowel disorders; 3) ascertain if there is a relationship between insomnia and bowel disorders for Canadians aged 12 and older; and 4) should a relationship exist, establish if there is a trend.

## MATERIALS AND METHODS

### Data Source

Our data is from the Canadian Community Health Survey (CCHS), Cycle 1.1, conducted by Statistics Canada.<sup>16</sup> The CCHS is a cross-sectional survey collecting responses from persons aged 12 or older, living in private occupied dwellings with questions related to health status, health care utilization, and health determinants for the Canadian population. Excluded from the sampling frame are individuals living on Indian Reserves and on Crown Lands, institutional residents, full-time members of the Canadian Armed Forces, and residents of certain remote regions. The CCHS Cycle 1.1 covered approximately 98% of the Canadian population aged 12 or older representing 136 health regions across the country.

Study-specific ethics approval was covered by the publicly available data clause (Item 1.3.1) governing the use of public release data set under the University of British Columbia's Policy #89 – Research and Other Studies Involving Human Subjects.

Collection for CCHS Cycle 1.1 took place between September 2000 and November 2001. In this time frame, a total of 136,937 households were approached to participate in the CCHS Cycle 1.1. Of these, a response was obtained for 125,159, which resulted in an overall household-level response rate of 91.4%. Among these responding households, 142,421 individuals were asked to participate in the interviews (conducted using computer-assisted interviewing). Excluded from our analysis were respondents with missing or unknown values for the six variables of interest in our study (outlined below). As a result, our analytic sample contained a total of 110,752 respondents.

### Outcome Variable

Survey respondents were asked, “Do you have a bowel disorder such as Crohn’s Disease or colitis?” A dichotomous response (yes/no) was recorded.

### Independent Variables

#### Primary Explanatory Variable

Survey respondents were asked, “How often do you have trouble going to sleep or staying asleep?” Available response categories were “most of the time”, “sometimes”, “never”, and “don’t know”. For the purposes of our study, those who answered that they had trouble going to sleep “most of the time” were deemed to be suffering from insomnia. This definition is similar to what has been used in the past for other epidemiological studies measuring insomnia.<sup>2</sup>

#### Potential Confounders

Age, sex, self-perceived stress, and chronic fatigue syndrome were selected as potential confounders in the statistical analyses.

Stress was included in the analysis as a possible confounder since Sutton *et al.*<sup>2</sup> observed an association between stress and insomnia. Stress has also been reported to affect the gastrointestinal system resulting in changes in bowel pattern and abdominal pain or discomfort.<sup>17</sup> For CCHS Cycle 1.1, the question employed in our analysis was related to self-perceived stress in an individual’s life. Respondents were asked to answer this question using the following five options provided in the survey: 1) not at all stressful; 2) not very stressful; 3) a bit stressful; 4) quite a bit stressful; and 5) extremely stressful.

Another potential confounder is if an individual suffers from chronic fatigue syndrome. In their review article, Afari and Buchwald<sup>18</sup> found that chronic fatigue syndrome patients report more difficulty falling asleep. The authors also found that this syndrome often co-occurs with other functional illnesses such as irritable bowel disorder. Survey respondents were asked “Do you have chronic fatigue syndrome?” with a response choice of either yes or no.

## Statistical Analysis

The prevalence of insomnia and bowel disorders in the Canadian population (aged 12+) was determined by frequency tabulations. The data set was stratified by the presence or absence of bowel disorders and was subsequently characterized by study variables including age, sex, and other health related questions e.g. self-perceived health and activity level. Chi square analyses were conducted to ascertain an association between the outcome variable and each of the various explanatory variables.

We calculated bivariate odds ratios to estimate the probability of suffering from bowel disorders associated with insomnia. Unadjusted models were also created for each of the independent variables to investigate their association with bowel disorder. All the independent variables were then entered into a multivariate logistic regression model to obtain odds estimates of experiencing bowel disorders if suffering from insomnia adjusted for the presence of the other independent variables in the model. An *a priori* decision was made to include all explanatory variables in the final multivariate logistic regression model as these variables were selected for analysis based on literature findings.

In order for the data from the survey responses to be representative of the household population of Canada (aged 12+), a survey weight was applied to each person who responded to the survey to provide an estimate of who they represented

**Table 1.** Profile of Study Participants Overall and by the Presence of Bowel Disorder, CCHS Cycle 1.1 (N = 110,752).

Characteristic	% Overall*	Bowel Disorder		p-value
		Yes	No	
<b>Sex</b>				
Male	47.53	30.10	47.94	<0.0001
Female	52.47	69.90	52.06	
<b>Age</b>				
12 to 19	3.35	0.95	3.41	<0.0001
20 to 29	17.55	12.54	17.67	
30 to 39	20.52	16.05	20.63	
40 to 49	22.13	22.72	22.11	
50 to 59	15.78	19.76	15.68	
60 to 69	10.26	11.62	10.23	
70 to 79	7.40	11.28	7.31	
80+	3.00	5.08	2.95	
<b>Self-perceived stress</b>				
Not at all	12.75	9.02	12.84	<0.0001
Not very	21.76	18.08	21.85	
A bit	39.73	38.58	39.75	
Quite a bit	21.13	26.65	21.00	
Extremely	4.63	7.68	4.56	
<b>Chronic fatigue syndrome</b>				
No	99.16	95.96	99.23	<0.0001
Yes	0.84	4.04	0.77	
<b>Frequency – trouble sleeping</b>				
Never	51.96	31.08	52.45	<0.0001
Sometimes	34.01	38.75	33.89	
Most of the time	14.03	30.17	13.55	
(insomnia)				

\*Weighted percentage according to Statistics Canada

p<0.05 was considered statistically significant for examining the correlation of each listed characteristic with the study's outcome variable (bowel disorder).

at a population level and to account for unequal probability of selection into the survey. This weight adjusted for the number of telephones in the household, the number of individuals in the household aged 12+, non-response, and seasonality. As such, our analytic sample size of 110,752 reflects a Canadian household population (aged 12+) of 21,520,586. Probability weights were used in the logistic models to provide weighted effect estimates and precise estimates of variance around these point estimates. All statistical analyses were conducted using SAS software (version 9.1) (SAS Institute Inc., 2002). All p-values were two-sided, and a p<0.05 was considered statistically significant.

## RESULTS

### Profile of Study Population

Based on our analytic sample, the prevalence of insomnia and bowel disorders was calculated to be 14.03% and 2.30%, respectively. Table 1 presents the overall frequency distribution for our dataset as well as for those who have bowel disorders and those who do not.

A review of Table 1 shows those who have a bowel disorder are more likely to: be women, have the disorder with advancing age, have more stress in their lives, suffer from chronic fatigue syndrome, and report having trouble going to sleep more frequently. Bivariate analysis using the Chi-square test showed a statistically significant association between each of the explanatory variables and the outcome variable.

With respect to characterizing those with bowel disorders, our analysis also suggests this cohort is more likely to: view themselves as having poorer health; have a regular medical doctor; consult an alternative health care provider; attend a self-help group; report decreases in activity at home, work or school, as well as in other leisure activities; and use sleeping pills (results not shown).

### Association between Insomnia and Bowel Disorders

Table 2 presents the odds of having a bowel disorder based on the independent variables examined. The unadjusted odds ratios for the association between bowel disorders and the frequency of trouble sleeping are: a) Never: 1.00 (reference); b) Sometimes: 1.93 (95% CI: 1.76-2.12); and c) Most of the time: 3.73 (95% CI: 3.37-4.12). When adjusted for age, sex, self-perceived stress and chronic fatigue syndrome, the odds ratio for this same relationship is: a) Never: 1.00 (reference); b) Sometimes: 1.71 (95% CI: 1.55-1.88); and c) Most of the time: 2.79 (95% CI: 2.51-3.10). (The correlation between the variables in the adjusted model was 0.50 or less). These results suggest the probability of having a bowel disorder increases if the individual has trouble sleeping (either sometimes or most of the time). In fact, a trend exists such that the probability of suffering from a bowel disorder increases along with the frequency of trouble sleeping. The odds of having a bowel disorder is also elevated: 1) if the individual is female; 2) as one advances in age; 3) if there is a higher degree of self-perceived stress; and 4) if the individual suffers from chronic fatigue syndrome.

**Table 2.** Odds Ratios (95% Confidence Intervals) of the relationship between insomnia and bowel disorder, adjusted for covariates and confounders, CCHS Cycle 1.1 (N = 110,752).

Variable	Unadjusted	Adjusted*
<b>Sex</b>		
Male	1.00	1.00
Female	2.14 (1.97 – 2.33)	1.85 (1.70 – 2.02)
<b>Age</b>		
12 to 19	1.00	1.00
20 to 29	2.56 (1.69 – 3.87)	2.57 (1.70 – 3.90)
30 to 39	2.80 (1.86 – 4.23)	2.71 (1.79 – 4.10)
40 to 49	3.70 (2.46 – 5.57)	3.36 (2.23 – 5.06)
50 to 59	4.54 (3.01 – 6.84)	4.09 (2.71 – 6.17)
60 to 69	4.09 (2.70 – 6.21)	3.93 (2.59 – 5.97)
70 to 79	5.56 (3.67 – 8.44)	5.24 (3.44 – 7.96)
80+	6.20 (4.00 – 9.60)	5.63 (3.63 – 8.74)
<b>Self-perceived stress</b>		
Not at all	1.00	1.00
Not very	1.18 (1.00 – 1.38)	1.18 (1.01 – 1.39)
A bit	1.38 (1.20 – 1.60)	1.42 (1.22 – 1.64)
Quite a bit	1.81 (1.55 – 2.10)	1.67 (1.43 – 1.96)
Extremely	2.40 (1.97 – 2.91)	1.81 (1.48 – 2.22)
<b>Chronic fatigue syndrome</b>		
No	1.00	1.00
Yes	5.45 (4.42 – 6.71)	3.04 (2.45 – 3.77)
<b>Frequency – trouble sleeping</b>		
Never	1.00	1.00
Sometimes	1.93 (1.76 – 2.12)	1.71 (1.55 – 1.88)
Most of the time (insomnia)	3.73 (3.37 – 4.12)	2.79 (2.51 – 3.10)

\*Adjusted for age, sex, self-perceived stress, and chronic fatigue syndrome.

## DISCUSSION

With respect to the main research question, our results suggest insomnia is strongly associated with an increased probability of suffering from a bowel disorder even when controlled for sex, age, self-perceived stress, and chronic fatigue syndrome. Our findings support the results of the other population-based study conducted by Vege *et al.*<sup>14</sup> Both studies reported statistically significant results; however, our adjusted odds ratio of 2.79 was slightly higher than the 1.6 reported by Vege *et al.*<sup>14</sup> In addition, we found a stepwise trend in that the more difficulty one has falling asleep, the more likely they were to suffer from a bowel disorder. Not only does this support the findings by Cremonini *et al.*,<sup>15</sup> but this trend also confirms our hypothesis that the more a Canadian suffers from insomnia, the greater the probability of experiencing bowel disorders. This is noteworthy as many studies have suggested the reverse relationship – that bowel disorders cause sleep disturbances.<sup>19-21</sup> Given the fact that we employed an overarching health survey asking questions on a number of health-related issues, bias is minimized because respondents were not simply asked questions related to our hypothesis. As such, we believe there is evidence to suggest that insomnia corresponds to an increased probability of suffering from bowel disorders.

However, the actual mechanism by which lack of sleep induces bowel disorders remains unclear. In their recent review

article on sleep and chronic inflammatory disorders, Ranjbaran *et al.*<sup>22</sup> found sufficient evidence proving changes in immune system function are caused by sleep disruptions. As there is an association between immune function and the sleep-wake cycle, the authors hypothesize sleep disruption plays a significant role in immunoinflammatory responses that cause or contribute to chronic inflammatory conditions such as IBS. The finding of a stepwise trend in association between insomnia and gastrointestinal disorders has been supported by animal studies.<sup>23,24</sup>

The characteristics of those individuals in our dataset with bowel disorders mirror the findings of previous studies.<sup>25,26</sup> Our study also confirms those with bowel disorders have a reduction in their health-related quality of life. This is not surprising given the myriad of symptoms associated with bowel disorders as well as the range in severity of such symptoms.

We calculated the prevalence of insomnia and bowel disorders to be 14.03% and 2.30% amongst adult Canadians respectively. Both of these figures are below the population estimates suggested in the literature. Sutton *et al.*<sup>2</sup> calculated the prevalence of insomnia in Canada (aged 15+) to be 24%. A reason for this discrepancy likely lies in how insomnia is ascertained among respondents – both in the way the question is worded as well as the available response options found in the survey. In their questionnaire, Sutton asked respondents, “Do you regularly have trouble going to sleep or staying asleep?” with a dichotomous (yes/no) response option. Recall that the question in the CCHS Cycle 1.1 survey inquired about the frequency of having trouble falling asleep with three response options. It should be noted that variations in the prevalence of insomnia are not uncommon as the literature has found levels from as low as 5% to as high as 50%, depending on the definition employed in the study.<sup>27</sup> In fact, combining those who reported trouble sleeping “most of the time” and “sometimes” in the current study make up 48% of the study sample.

Thompson *et al.*<sup>7</sup> determined the prevalence of IBS to be 12.1% in Canada. One possible explanation for our lower figure is that the CCHS survey asked for medically-diagnosed bowel disorders whereas Thompson *et al.* utilized the Rome criteria.<sup>28</sup> This is of importance as the majority of people that experience bowel disorder symptoms do not seek medical attention.<sup>29,30</sup> As such, using a list of symptoms to identify subjects with a bowel disorder will likely elicit a higher prevalence among respondents as compared to identifying only respondents medically-diagnosed with bowel disorder. Also, due to the nature of the question “Do you have a bowel disorder such as Crohn’s Disease or colitis?” in the CCHS survey, it was not necessarily specific for IBS. In other words, it encompasses individuals with Crohn’s Disease or colitis or IBS, but we are unable to differentiate between disorders. Further, individuals with IBS may know that they do not have

“...our results suggest that insomnia is strongly associated with an increased probability of suffering from a bowel disorder...”

either Crohn's Disease or colitis, and therefore our results likely underestimate the prevalence of IBS. Nevertheless, our findings were in agreement with Thompson *et al.*<sup>8</sup> in that women have higher prevalence of bowel disorders in Canada.

One of the strengths of our study is that it was based on a population representative of Canadians. This resulted in less bias overall and gave our findings a great deal of external validity. Our study also had a very large sample size which provided sufficient power. Based on our sample size of 110,752 respondents, we obtained a power of >0.999 in order to detect a difference in the event rate of the proportion of people who do not sleep well versus those individuals who do sleep well (0.05 vs. 0.014, respectively).<sup>31</sup> Our study is not without limitations, however. We relied on self-reported information which is subject to recall bias as well as subjective interpretation of questions. In particular, there were no definitions for the three response options available for the question related to sleeping difficulty in the CCHS survey ("most of the time", "sometimes", and "never"). In addition, there may be other possible confounders, such as caffeine consumption, not factored into the model. However, this variable was not measured in the survey, and we are not certain if this is a true confounder in the relationship between insomnia and bowel disorders given the current evidence. Lastly, our study was cross-sectional in nature and therefore may be affected by those limitations associated with this particular study design.

In summary, our population-based study indicates there is a stepwise association between insomnia and bowel disorders in Canada. However, given the limited amount of population-based data, more studies are warranted to examine this relationship further. Future studies should consider having clinical definitions and/or criteria for both insomnia and bowel disorders to minimize the subjectivity of responses. Also, case-control studies are suggested to clearly demonstrate that insomnia results in an increased risk of experiencing bowel disorders. Nevertheless, the results of our study lend evidence that the frequency of trouble sleeping is associated with the likelihood of suffering from a bowel disorder among Canadians. 

## ACKNOWLEDGEMENTS

The authors wish to thank the following individuals from the School of Population and Public Health at the University of British Columbia who helped to review the manuscript: M. Koehoorn, W. Zhang, M.J. Milloy, and A. Harris.

## REFERENCES

- Doghramji K. The epidemiology and diagnosis of Insomnia. *Am J Manag Care.* 2006;12:S214-S222.
- Sutton DA, Moldofsky H, Badley EM. Insomnia and health problems in Canadians. *Sleep.* 2001;24(6):665-70.
- Hossain JL and Shapiro CM. The prevalence, cost implications, and management of sleep disorders: an overview. *Sleep Breath.* 2002;6(2):85-102.
- Thase ME. Correlates and consequences of chronic insomnia. *Gen Hosp Psychiatry.* 2005;27:100-12.
- Orr W and Chen CL. Sleep and the gastrointestinal tract. *Neurol Clin.* 2005; 23:1007-24.
- Heitkemper M, Faan RL, Burr M, *et al.* Evidence for autonomic nervous system imbalance in women with irritable bowel syndrome. *Dig Dis Sci.* 1998;43:2093-98.
- Bernstein CN, Wajda A, Svenson LW, MacKenzie A, Koehoorn M, Jackson M, Fedorak R, Israel D, Blanchard JF. The epidemiology of inflammatory bowel disease in Canada: a population-based study. *Am J Gastro.* 2006;101:1559-68.
- Thompson WG, Irvine EJ, Pare P, Ferrazzi S, Rance L. Functional gastrointestinal disorders in Canada. *Dig Dis Sci.* 2002;47(1):225-35.
- Bentkover JD, Field C, Greene EM, Plourde V, Casciano JP. The economic burden of irritable bowel syndrome in Canada. *Gastroenterology.* 1998;114(4):A720 (Abstract).
- Goldsmith G, Levin JS. Effect of sleep quality in symptoms of irritable bowel syndrome. *Dig Dis Sci.* 1993;38:1809-14.
- Jarrett M, Heitkemper M, Cain KC, Burr RL, Hertig V. Sleep disturbance influences gastrointestinal symptoms in women with irritable bowel syndrome. *Dig Dis Sci.* 2000;45:952-59.
- Akerstedt T. Shift work and disturbed sleep/wakefulness. *Sleep Medicine Reviews.* 1998;2(2):117-28.
- Lu WZ, Gwee KA, Ho KY. Functional bowel disorders in rotating shift nurses may be related to sleep disturbances. *Eur J Gastroenterol Hepatol.* 2006;18:623-27.
- Vege SS, Locke GR III, Weaver AL, Farmer SA, Melton LJ III, Talley NJ. Functional gastrointestinal disorders among people with sleep disturbances: a population-based study. *Mayo Clin Proc.* 2004;79:1501-06.
- Cremonini F, Camilleri M, Zinsmeister AR, Herrick LM, Beebe T, Talley NG. Sleep disturbances are linked to both upper and lower gastrointestinal symptoms in the general population. *Neurogastroenterol Motil.* 2009;21:128-35.
- Statistics Canada. Canadian Community Health Survey (CCHS), Cycle 1.1. Public Use Microdata File (PUMF) User Guide. November 2002. Retrieved on September 18, 2008, Available from: <http://data.library.ubc.ca/java/jsp/database/production/detail.jsp?id=776>.
- The American Gastroenterological Association Clinical Practice Committee. AGA technical review on irritable bowel syndrome. *Gastroenterology* 2002;123:2108-31.
- Afari N and Buchwald D. Chronic fatigue syndrome: a review. *Am J Psychiatry.* 2003;160:221-36.
- Ranjbaran Z, Keefer L, Farhadi A, Stepanski E, Sedghi S, Keshavarzian A. Impact of sleep disturbances in inflammatory bowel disease. *J Gastro Hep.* 2007;22:1748-53.
- Rotem AY, Sperber AD, Krugliak P, Freidman B, Tal A, Tarasiuk A. Polysomnographic and actigraphic evidence of sleep fragmentations in patients with irritable bowel syndrome. *Sleep.* 2003;26:747-52.
- Elsenbruch S, Harnish MJ, Orr WC. Subjective and objective sleep quality in irritable bowel syndrome. *Am. J. Gastroenterol.* 1999;94:2447-52.
- Ranjbaran Z, Keefer L, Stepanski E, Farhadi A, Keshavarzian A. The relevance of sleep abnormalities to chronic inflammatory conditions. *Inflamm. Res.* 2007;56:51-57.
- Preuss F, Tang Y, Laposky AD, Arble D, Keshavarzian A, Turek W. Adverse effects of chronic circadian desynchronization in animals in a "challenging" environment. *Am J Physiol Regul Integr Comp Physiol.* 2008;295:R2034-R2040.
- Tang Y, Preuss F, Turek FW, Jakate S, Keshavarzian A. Sleep deprivation worsens inflammation and delays recovery in a mouse model of colitis. *Sleep Med.* 2009;10:597-603.
- Gralnek IM, Hays RD, Kilbourne A, Naliboff B, Mayer EA. The impact of irritable bowel syndrome on health-related quality of life. *Gastroenterology* 2000;119:655-60.
- Amouretti M, Le Pen C, Gaudin AF, Bommelaer G, Frexinos J, Ruszniewski P, Poynard T, Maurel F, Priol G, El Hasnaoui A. Impact of irritable bowel syndrome (IBS) on health-related quality of life (HRQOL). *Gastroenterol Clin Bio.* 2006;30:241-46.
- Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. *Sleep Med Rev.* 2002;6:97-111.
- Thompson WG, Longstreth G, Drossman DA, Heaton KW, Irvine EJ, Muller-Lissner SA. Functional bowel disease and functional abdominal pain. *Gut.* 1999;45(suppl II):43-47.
- Drossman DA, Sandler RS, McKee DC, Lovitz AJ. Bowel patterns among subjects not seeking health care. Use of a questionnaire to identify a population with bowel dysfunction. *Gastroenterology* 1982;83:529-34.
- Thompson WG and Heaton KW. Functional bowel disorders in apparently healthy people. *Gastroenterology* 1980;79:283-88.
- Hsieh FY, Bloch DA, Larsen D. A simple method of sample size calculation for linear and logistic regression. *Stat Med.* 1998;17(14):1623-34.

# Permanent Childhood Hearing Impairment and the Universal Newborn Hearing Screening Program in British Columbia

Renée M. Janssen, MSc Aud<sup>a</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2013, Faculty of Medicine, University of British Columbia, Vancouver, BC

## ABSTRACT

Hearing loss is a relatively common congenital disorder, affecting an estimated one to three in every 1,000 live births. Untreated hearing loss in early childhood affects the development of speech and language, and later, academic success. Prior to universal newborn hearing screening, the age of identification of permanent congenital hearing loss in infants was quite delayed, due in part to the absence of risk factors in the majority children with congenital hearing loss. This article provides a brief overview of the causes and impact of permanent childhood hearing impairment, and introduces the universal newborn hearing screening program in British Columbia (BC). The BC Early Hearing Program, announced by the provincial government in March 2005, provides newborn hearing screening, diagnostic assessments, the first set of hearing devices, and ongoing communication and family support services.

**KEYWORDS:** *universal newborn hearing screening, hearing screening, hearing impairment, permanent childhood hearing impairment*

## DEVELOPMENT OF SPEECH AND LANGUAGE, AND THE IMPACT OF HEARING LOSS

Infants tune in to the surrounding linguistic world early in development. They are able to discriminate subtle speech sounds at birth; by six to twelve months of age, they begin to show a decline in their ability to discriminate non-native speech sounds and an enhancement in their ability to discriminate native speech sounds.<sup>1</sup> Thus, infants develop a bias towards their native language from a very early age.

Congenital hearing loss affects the quality and quantity of these early listening experiences. Prelingual auditory deprivation leads to language delay, the severity of which correlates with the severity of the hearing loss. Children with hearing loss have poorer language measures than their normal-hearing peers; language outcomes in children with hearing loss are much poorer than would be predicted by their non-verbal intelligence.<sup>2-5</sup> Language skills are critical for attaining literacy as well as other cognitive skills; as such, deaf children have notably poorer academic success (for a review, see Helfand *et al.*<sup>6</sup>). Additionally, children with hearing loss exhibit more behavioural problems than their normal-hearing peers.<sup>7,8</sup>

### Correspondence

Renée M. Janssen, renee.janssen.king@gmail.com

## PERMANENT CONGENITAL HEARING IMPAIRMENT

Hearing loss is a relatively common congenital disorder. Approximately one to three in every 1,000 infants are born with permanent hearing loss; the number increases to one in every 40 for infants who require care in the Neonatal Intensive Care Unit (NICU).<sup>9-12</sup> The causes of congenital hearing loss in infants include:

1. anatomic abnormalities of the ear (outer, middle and/or inner);
2. syndromal genetic disorders (e.g., Down Syndrome, Waardenburg syndrome);<sup>13</sup>
3. non-syndromal hereditary hearing loss (i.e., hearing loss in isolation) – patterns of inheritance include autosomal dominant, autosomal recessive, mitochondrial, and X-linked<sup>13</sup> (see the Hereditary Hearing Loss Homepage for an overview of the genetic causes of hearing loss<sup>14</sup>);
4. in utero infections (toxoplasmosis, rubella, cytomegalovirus, herpes, syphilis);<sup>15</sup> and
5. exposure to ototoxic drugs such as alcohol, cisplatin, and isotretinoin during pregnancy.<sup>15</sup>

Risk factors for hearing loss include meningitis, hyperbilirubinemia requiring exchange transfusion, low birth weight, respiratory distress, prolonged mechanical ventilation, low Apgar scores, exposure to ototoxic medications such as gentamicin and loop diuretics, and family history of childhood hearing impairment.<sup>16</sup>

“ **Universal newborn hearing screening is the best way to ensure that all children with significant congenital hearing loss will be identified early.** ”

Genetic causes account for over half of children with permanent congenital hearing loss.<sup>13</sup> Of these, approximately 75% have non-syndromal hereditary hearing loss, i.e., they have hearing loss in isolation, with no other associated medical issues.<sup>17</sup> At least half of non-syndromal hereditary hearing loss is associated with a defect in the Cx26 gene, which encodes a connexin gap junction protein.<sup>18</sup> This genetic defect displays a recessive pattern of inheritance.

## IDENTIFICATION OF PERMANENT CHILDHOOD HEARING LOSS BEFORE UNIVERSAL SCREENING

Infants with hearing loss generally develop normal early communication skills such as eye contact, smiling, gesturing, and babbling.<sup>19</sup> For this reason, it is difficult to identify infants who have hearing loss based on behavioural observation alone.

Before the advent of universal newborn hearing screening, children were usually assessed for hearing loss based on whether they had known risk factors (such as a lengthy stay in the NICU, or a family history of hearing loss) or when there was parental concern. However, at least half of the children found to have permanent congenital hearing loss do not have risk factors.<sup>20</sup>

Historically, assessment of children based on the presence of risk factors led to diagnosis by approximately 12 months of age.<sup>20</sup> Children who had a severe or profound degree of hearing loss were typically identified earlier than those children with a lesser degree of hearing loss, as behaviours associated with a severe to profound loss are more apparent.<sup>5</sup> The average age of identification in children with mild to moderate degrees of hearing loss was approximately two years of age.<sup>20</sup>

Given that at least half of all children with permanent congenital hearing loss will have no apparent risk factor, and given the lack of early reliable behavioural indicators of hearing loss, targeted screening would miss many children with hearing loss. Universal newborn hearing screening is the best way to ensure that all children with significant congenital hearing loss will be identified early.

The U.S. Preventive Services Task Force recommends screening for hearing loss in all newborns (B recommendation<sup>21</sup>); with recent advances in hearing assessment techniques, this has become feasible. Universal newborn hearing screening programs are in place or under development in many countries such as the United States, the United Kingdom, Canada, Australia, and New Zealand.

## THE BRITISH COLUMBIA EARLY HEARING PROGRAM (BCEHP)

The BC Early Hearing Program (BCEHP) is the first province-wide hearing screening program in British Columbia. The program was announced in March 2005 and was fully implemented across all health authorities by 2009. The program provides newborn hearing screening, follow-up diagnostic assessments, the first set of hearing aids, and ongoing communication and family support services. It is delivered by approximately 350 service providers and professionals in British Columbia's six regional health authorities.<sup>22</sup>

## HEARING SCREENING IN THE NEWBORN

Most infants have their hearing screened before they are discharged from the hospital; for those who do not have screening completed by the time of discharge, the family is offered a follow-up appointment, usually at the local community public health audiology clinic.

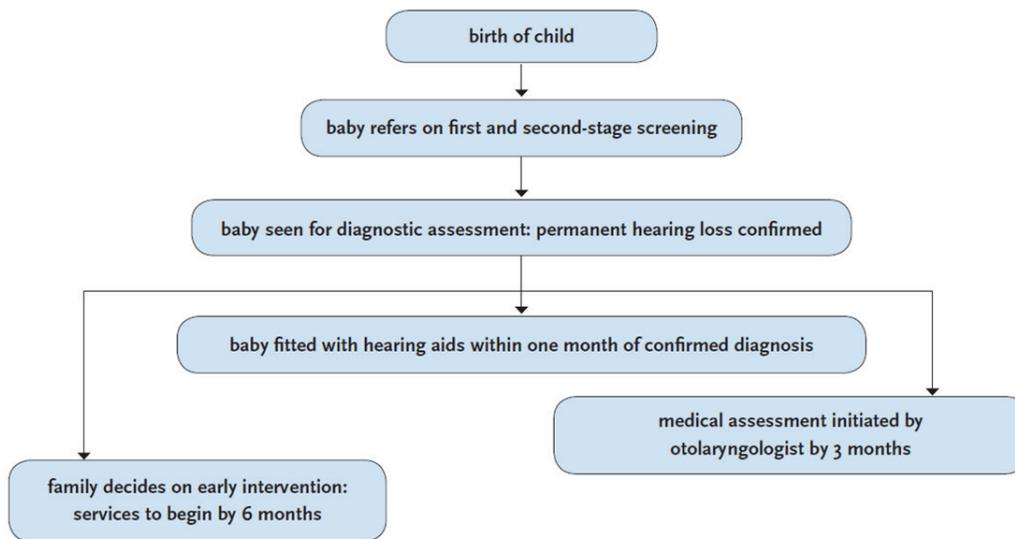
Similar to universal newborn hearing screening programs in other countries, there are two screening methods in use in British Columbia:

1. **Automated Otoacoustic Emissions:** Otoacoustic emissions (OAEs), first characterized by Kemp in 1978, are sounds actively generated by the outer hair cells of the inner ear in response to incoming sound.<sup>23</sup> A probe is placed in the infant's ear, and soft clicks are presented. The probe automatically detects the presence or absence of the OAEs in response to the clicks. OAEs reflect the status of the peripheral auditory system (outer, middle, and inner ears).
2. **Automated Auditory Brainstem Response:** The auditory brainstem response (ABR) is generated by the synchronous firing of neurons in the auditory nerve and brainstem in response to sound.<sup>24</sup> Electrodes are placed on the forehead and nape of the neck, and sounds are presented to the ears via earphones. For the purpose of screening, response detection is automated. The ABR reflects the status of the peripheral auditory system and auditory neural pathway to the level of the brainstem.

Hearing screening is a two-stage process:

1. Infants who pass the first screening do not need any further testing. Sensitivity of hearing screening is estimated at 94%;<sup>25</sup> i.e. very few infants who have significant hearing loss will have a “pass” result.
2. Those who do not pass the first screening will have a second screening. This increases the specificity of the screening by reducing the number of false positives. The referral rate from first stage screening is approximately eight percent.<sup>26</sup>
3. Those who do not pass the second screening will be referred for a full diagnostic assessment with an audiologist. The referral rate to diagnostics from screening for the 2008/2009 fiscal year was two percent in BC, which is below the benchmark of four percent set by the American Academy of Pediatrics.<sup>16,27</sup>

Timeline for a typical child identified with permanent hearing loss: first six months.



**Figure 1.** Timeline of the first six months of life for a typical child diagnosed with permanent congenital hearing loss through the BCEHP.

## DIAGNOSIS AND MANAGEMENT OF CONGENITAL PERMANENT HEARING LOSS

Infants who do not pass screening are seen for a full diagnostic assessment with an audiologist at one to two months of age. Infants at this age are too young for reliable behavioural testing; the gold-standard method of infant hearing assessment is by diagnostic tone-evoked ABR in conjunction with other supportive tests.<sup>16</sup> The diagnostic tone ABR is very similar to the screening ABR, but does not employ automatic response detection, providing a much larger degree of diagnostic detail about hearing status. It is performed by an audiologist with training in infant assessment techniques. An infant is fit with electrodes and headphones, and the elicited ABR waveforms are interpreted by an audiologist. The infant must be asleep, as any muscle movement or tension creates myogenic artefacts that interfere with waveform interpretation. This test takes approximately one hour of sleep time (often less if hearing is normal).<sup>28</sup> When hearing loss is identified, a second appointment is often required to obtain more information.<sup>28</sup> In the case of normal hearing it is sufficient to determine that hearing sensitivity is within the normal range; however, when there is hearing loss present, more ABR waveforms must be obtained to accurately characterize the hearing loss for optimal habilitation with amplification devices such as hearing aids.

Once the hearing loss has been confirmed and quantified, the child requires a medical evaluation by an otolaryngologist. The purpose of the medical evaluation is to investigate the etiology of the hearing loss, to evaluate for other complications or concomitant disorders, and to prevent/manage future deterioration of the hearing loss. Investigation of etiology involves a thorough

history and physical examination, imaging of the ear, and targeted genetic testing.<sup>29</sup> At this time, the only genetic screening available in British Columbia for non-syndromic hereditary hearing loss is for the Cx26 gene, as discussed above. A full review of the BCEHP guidelines for the medical management of children newly diagnosed with permanent hearing loss is available on the BCEHP website.<sup>22</sup>

Additionally, the child will receive a fitting with hearing aid(s) (if appropriate), and the family will enrol in an early intervention program to aid in the development of speech, listening, and language skills. The first set of hearing aids, including batteries

and earmolds, are provided by the BCEHP at no cost to the family. For more information about Early Intervention and the Hearing Aid Program, please see the BCEHP website.<sup>22</sup>

Figure 1 shows the timeline of events from birth through the first six months of a child identified with permanent congenital hearing loss through the BCEHP. The BCEHP protocol, which requires screening by one month, diagnosis of hearing loss by three months, and early intervention (including hearing devices) by six months of age, is in line with the Joint Committee on Infant Hearing recommendations.<sup>16</sup>

## THE ROLE OF THE FAMILY PHYSICIAN/ PAEDIATRICIAN

Identification of permanent hearing loss in a newborn is often a time of intense emotions for the family.<sup>30</sup> While children who are identified with hearing loss, fitted with hearing aids, and enrolled in an early intervention program by age six months have a good prognosis for speech and language development, it is still a difficult time of adjustment for the family, and family-centred support is important during this period.<sup>31,32</sup> Good interdisciplinary communication between the audiologist and the primary care physician is critical to ensure families receive consistent information.

It is important to be aware that not all permanent childhood hearing loss is present at birth; some children will develop hearing loss later in childhood. Within the BCEHP, children who pass screening at birth but have risk factors for progressive hearing loss\* are monitored until three years of age. However, as discussed, not all children with hearing loss have identifiable risk

\*Risk factor criteria for BCEHP monitoring<sup>27</sup> are: craniofacial anomalies (not ear pits or tags); close relative (parent, sibling, uncle, aunt, cousin, grandparent) who had permanent hearing loss before 12 years of age; syndrome associated with late onset/progressive hearing loss; birthweight less than 1200 grams; five-minute Apgar score less than or equal to 3; hypoxic-ischemic encephalopathy (HIE) moderate/severe (Sarnat II or III); congenital diaphragmatic hernia (CDH); extra-corporeal membrane oxygenation (ECMO), or inhaled Nitrous Oxide (iNO) or High-Frequency Oscillatory (HFO) or Jet (HFJ) ventilation; intra-ventricular hemorrhage (IVH), Grade III or IV; peri-ventricular leukomalacia (PVL); hyperbilirubinemia > 400  $\mu\text{mol}$  or meeting any standard criteria for exchange; perinatal (in the baby) TORCHS infection (toxoplasmosis, rubella, cytomegalovirus (CMV), herpes, syphilis); meningitis, irrespective of the pathogen; and accidental overdose of gentamicin or other aminoglycosides, five-fold or greater.

factors. If there is a speech-language delay, or parental concern about hearing, then the child should be referred for a hearing assessment at the nearest public health audiology clinic regardless of screening results or the absence of risk factors.

The American Academy of Pediatrics<sup>16</sup> outlines the following roles for the pediatrician/primary care physician:

1. Monitor the general health, development, and well-being of the infant, including developmental milestones;
2. Ensure that families follow through with hearing screening and diagnostic audiology appointments;
3. Initiate medical referrals for medical specialty evaluations for the determination of etiology of the hearing loss;<sup>#</sup>
4. Monitor middle ear status for temporary outer/middle ear pathology such as otitis media, as this can impede screening and diagnostic testing, or add to the degree of loss in the case of permanent hearing loss;
5. Review the infant's medical and family history for the presence of risk factors that require monitoring for progressive or delayed-onset hearing loss;
6. Attend to parental concerns regarding speech and language development, hearing, and other developmental milestones.

The BCEHP is quite new, and permanent childhood hearing impairment, while not rare, is not a common diagnosis; for these reasons, primary care physicians may not be aware of the BCEHP, and may not know how to communicate with families who have just had their child diagnosed with hearing loss. The BCEHP website has information for physicians about hearing screening, diagnostic assessment of hearing loss, early intervention programs, and the BCEHP guidelines for medical management of children newly diagnosed with hearing loss.<sup>22</sup> 

## REFERENCES

1. Polka L., Werker J. Developmental changes in perception of nonnative vowel contrasts. *J Exp Psychol [Hum Percept]*. 1994;20(2):421-435.
2. Moeller MP. Early intervention and language development in children who are deaf and hard of hearing. *Pediatrics*. 2000;106:E43.
3. Davis JM, Elfenbein JL, Schum R, Bentler R. Effects of mild and moderate hearing impairments on language, educational, and psychosocial behavior of children. *J Speech Hear Disord*. 1986 Feb;51:53-62.
4. Elfenbein JL, Hardin-Jones MA, Davis JM. Oral communication skills of children who are hard of hearing. *J Speech Hear Res*. 1994;37:216-26.
5. Wake M, Poulakis Z, Hughes EK, Carey-Sargeant C, Rickards FW. Hearing impairment: A population study of age at diagnosis, severity, and language outcomes at 7-8 years. *Arch Dis Child*. 2005;90(3):238-44.
6. Helfand M, Thompson D, Davis R, McPhillips H, Homer C, Lieu T. Newborn hearing screening. Systematic evidence review number 5. Rockville (MD): Agency for Healthcare Research and Quality; 2001. AHRQ Publication No. 02-S001. Contract No.: 290-97-0018 to the Oregon Health & Science University Evidence-based Practice Center, Portland, Oregon.
7. Davis A, Hind S. The impact of hearing impairment: a global health problem. *Int J Pediatr Otorhinolaryngol*. 1999;49(suppl 1):S51-S54.
8. Vostanis P, Hayes M, Feu MD, Warren J. Detection of behavioural and emotional problems in deaf children and adolescents: comparison of two rating scales. *Child Care Health Dev*. 1997; 23(3):233-46.
9. Davis A, Wood S. The epidemiology of childhood hearing impairment: factors relevant to planning of services. *Br J Audiol*. 1992 Apr;26:77-90.
10. Prieve BA, Stevens F. The New York State newborn hearing screening demonstrations project: introduction and overview. *Ear Hear*. 2000;21:85-91.
11. Wessex Universal Hearing Screening Trial Group. Controlled trial of universal neonatal screening for early identification of permanent childhood hearing impairment. *Lancet*. 1998;f52:1957-64.
12. Hille E, van Straaten H, Verkerk P. Prevalence and independent risk factors for hearing loss in NICU infants. *Acta Paediatr*. 2007;96:1155-8.
13. Toriello H, Reardon W, Gorlin R, editors. *Hereditary Hearing Loss and its Syndromes*. 2nd ed. New York: Oxford University Press; 2004.
14. Van Camp G, Smith RJH. Hereditary hearing loss [Internet]. [cited 2010 Feb 26]; Available from: <http://webhost.ua.ac.be/hhh/>.
15. Gifford KA, Homes MG, Bernstein HH. Hearing loss in children. *Pediatr Rev*. 2009;30(6):207-15.
16. Joint Committee on Infant Hearing. Year 2007 position statement: principles and guidelines for early hearing detection and intervention programs. *Pediatrics* 2007;120:898-921.
17. Morton NE. Genetic epidemiology of hearing impairment. *Ann N Y Acad Sci*. 1991;630:16-31.
18. Denoyelle F, Lina-Granade G, Plauchu H, Bruzzone R, Chaib H, Levi-Acobas F, et al. Connexin26 gene linked to a dominant deafness. *Nature*. 1998;393:319-20.
19. Oller DK, Eilers RE. The role of audition in infant babbling. *Child Dev*. 1988;59(2):441-9.
20. Harrison M, Roush J. Age of suspicion, identification, and intervention for infants and young children with hearing loss: a national study. *Ear Hear*. 1996;17(1):55-62.
21. U.S. Preventive Services Task Force. Universal screening for hearing loss in newborns: US Preventive Services Task Force recommendation statement. *Pediatrics*. 2008;122:143-8.
22. B.C. Early Hearing Program [homepage on the Internet]. [updated 2009 Sept 29; cited 2010 Feb 26]; Available from: <http://www.phsa.ca/AgenciesAndServices/Services/BCEarlyHearing/default.htm>.
23. Kemp DT. Stimulated acoustic emissions from within the human auditory system. *J Acoust Soc Am*. 1978;64:1386-91.
24. Slinger YS. The use of auditory brainstem response in screening for hearing loss and audiometric threshold prediction. In: Burkard RF, Don M, Eggermont JJ, editors. *Auditory Evoked Potentials. Basic Principles and Clinical Application*. Philadelphia: Lippincott, Williams & Wilkins; 2007. pp. 254-74.
25. Kennedy CR, McCann DC. 7 to 9 year outcome of the Wessex Controlled Trial of Universal Neonatal Hearing Screening (UNHS). *Arch Dis Child*. 2003;88:S1, A3.
26. Watkin PM. Neonatal screening – methods and outcome. *Audiol Med*. 2003;1:165-74.
27. B.C. Early Program Information Update [Internet]. Fall 2009 [cited 2010 April 4]; Available from: <http://www.phsa.ca/AgenciesAndServices/Services/BCEarlyHearing/ForPhysicians/default.htm>.
28. Janssen RM, Stapells DR. The British Columbia's Children's Hospital tone-evoked ABR protocol: how long do infants sleep, and how much information can be obtained in one appointment? *Ear Hear*. 2010 May [Epub ahead of print];31(5).
29. Morzaria S, Westerberg BD, Kozak FK. Evidence-based algorithm for the evaluation of a child with bilateral sensorineural hearing loss. *J Otolaryngol*. 2005;34(5):297-303.
30. Wood Jackson C, Randi J, Traub RJ, Turnbull AP. Parents' experiences with childhood deafness: implications for family-centered services. *Communication Disorders Quarterly*. 2008;29:82-98.
31. Kennedy CR, McCann DC, Campbell MJ, Law CM, Mullee M, Petrou S, et al. Language ability after early detection of permanent childhood hearing impairment. *N Engl J Med*. 2006;354:2131-41.
32. Meadow-Orlans KP, Mertens DM, Sass-Lehrer MA, Scott-Olson K. Support services for parents and their children who are deaf or hard of hearing: a national survey. *Am Ann Deaf*. 1997 Oct ;142(4):278-88.

<sup>#</sup>The BCEHP has an expedited medical referral process whereby designated otolaryngologists will accept referrals and ensure prompt medical evaluation of the child newly diagnosed with hearing loss. Please see the BCEHP website [www.phsa.ca/earlyhearing](http://www.phsa.ca/earlyhearing) for more information.

# Diabetes in South Asians: Etiology and the Complexities of Care

Anish R. Mitra, BASc<sup>a</sup>, Irvin Janjua, BMLSc<sup>a</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2012, Faculty of Medicine, University of British Columbia, Vancouver, BC

## ABSTRACT

Fifteen to twenty percent of South Asians will develop type 2 diabetes mellitus. This extremely high prevalence of diabetes is seen in both South Asians living in developed countries and in South Asians who are living in either urban or rural South Asia. South Asians have a tendency to develop metabolically active abdominal fat, resulting in a high risk of diabetes even at a low body mass index. They are also particularly vulnerable to microvascular and macrovascular diabetic complications, including renal and cardiac disease. The high prevalence of diabetes in South Asians is likely due to a combination of biological and cultural factors. Targeting these factors is an effective way to provide education, prevention, screening, and treatment to South Asians. Culturally-focused community programs and interprofessional care teams are two health care paradigms that have been successful in helping these individuals manage this chronic illness. Continuing culturally-targeted care and education programs is necessary to reduce the prevalence and complications of diabetes in South Asian communities.

**KEYWORDS:** *diabetes mellitus, type 2, patient care team, culture, asia*

## INTRODUCTION

**D**iabetes mellitus is a global epidemic affecting approximately 285 million people worldwide, a number that will likely increase to 439 million by 2030.<sup>1</sup> It is a chronic illness that can result in serious complications including coronary artery disease, nephropathy, neuropathy, and retinopathy over time. Diabetes mellitus also has a tremendous impact on economies. For example, in 2007, it was estimated that diabetes alone cost the United States \$116 billion in medical costs and \$58 billion in lost national productivity.<sup>2</sup>

There are two forms of diabetes mellitus. Type 1 diabetes, which is primarily due to  $\beta$ -cell destruction, has either an autoimmune or idiopathic etiology.<sup>3</sup> Type 2 diabetes is the more common variant, and can result from either an insulin secretion defect or insulin insensitivity.<sup>3</sup> This article will discuss only type 2 diabetes, which accounts for approximately 97% of cases of diabetes mellitus.<sup>4</sup>

South Asians, including Bangladeshis, Indians, Pakistanis, and Sri Lankans, are particularly vulnerable to diabetes. Although diabetes occurrence rates differ across South Asian ethnicities, all exhibit higher prevalence than is seen in Caucasians.<sup>5</sup> Approximately 15-20% of South Asians will develop diabetes compared to 2-5% of Caucasians.<sup>6-8</sup> This increased prevalence is seen in both South Asians who have migrated to the Western

world and South Asians living in either rural or urban South Asia.<sup>6,9-11</sup> Studies also suggest that the prevalence of diabetes in the South Asian population is on the rise and that it is also being diagnosed at a younger age.<sup>11, 12</sup>

### Risk Factors

The high prevalence of diabetes in South Asians is associated with certain metabolic risk factors in this population. Compared to Caucasian children, South Asian children have been shown to have increased plasma insulin in the setting of normal plasma glucose levels, an early sign of insulin insensitivity.<sup>13,14</sup>

As adults, South Asians continue to be at higher risk for insulin insensitivity, as well as other diabetes-associated risk factors including increased visceral adiposity, or intra-abdominal fat, which is metabolically active and strongly linked to insulin resistance.<sup>15,16</sup> Increased metabolically active intra-abdominal fat causes the Body Mass Index (BMI) risk criteria for Caucasians to be too lenient for South Asians because they have a higher ratio of metabolically active intra-abdominal fat to total body fat.<sup>16</sup> South Asians also have an increased waist-to-hip ratio and increased skinfold (suprascapular and subiliac) thickness, both of which are risk factors for diabetes.<sup>5,15</sup>

### Complications

South Asians are also at increased risk of developing both macrovascular and microvascular complications related to diabetes.<sup>7,17</sup> Development of secondary complications may be attributed to the early age of diabetes onset, resulting in prolonged

### Correspondence

Anish R. Mitra, anish@interchange.ubc.ca

exposure of body organs and tissues to high blood glucose levels.<sup>12</sup> In addition to being more susceptible to diabetes, South Asians also suffer from a higher prevalence of ischemic cardiovascular disease.<sup>9,18</sup> It has been theorized that increased insulin resistance increases the risk of thrombosis, which in turn increases the likelihood of developing coronary artery disease leading to ischemic cardiovascular disease.<sup>18,19</sup>

## ETIOLOGY

### Genetic and Environment

The reason South Asians are more susceptible to diabetes remains unclear. Two leading theories explaining this increased susceptibility are the thrifty phenotype and thrifty genotype hypotheses. Low birth weight plays a role in both theories, and studies have shown South Asians tend to have lower birth weight than Caucasians, predisposing South Asian infants to metabolic abnormalities.<sup>20,21</sup> Lower birth weight is also associated with an increased risk of cardiovascular events, which are also more common in South Asians.<sup>22</sup>

Hales and Barker postulate that lower birth weight relates to type 2 diabetes with their thrifty phenotype hypothesis, which attributes the vulnerability to diabetes to environmental factors in the womb rather than genetic characteristics in the fetus.<sup>20</sup> They suggest that nutritional deficiencies in utero, which result in lower birth weight, may also lead to reduced  $\beta$ -cell mass or impaired  $\beta$ -cell function. These atypical  $\beta$ -cells may be unable to produce sufficient insulin throughout the individual's life, resulting in overt diabetes when  $\beta$ -cell insulin secretion is unable to compensate for increased metabolic demand.<sup>20</sup>

The thrifty genotype hypothesis is an alternative theory, involving genetic abnormalities, which relates low birth weight to adult diabetes. This hypothesis suggests that low nutrient conditions in-utero result in selective survival of infants who have insulin insensitivity allowing for efficient intake and utilization of nutrients.<sup>21,23</sup> This genotype is beneficial in a low calorie environment, but may increase vulnerability to diabetes in an environment with an abundance of calories, as is found in most of the developed world.<sup>21,23</sup> Both of these hypotheses suggest further studies need to be conducted to examine whether South Asians are receiving insufficient nutrients in-utero and how this correlates with susceptibility to diabetes.

The high prevalence of diabetes in South Asian populations suggests they may carry genetic polymorphisms that increase their susceptibility to diabetes. The PC-1 K121Q polymorphism of the ENPP1 gene and non-coding variants of the TCF7L2 gene have been found to increase the vulnerability of both South Asians and Caucasians to diabetes.<sup>24,25</sup> However, due to the small sample sizes in these studies, additional studies must be conducted to test the validity of linking these polymorphisms to increased diabetic susceptibility and to determine if polymorphisms are responsible for the increased vulnerability seen in South Asians.

### Cultural

Culture is an amalgamation of behaviors, ideas, attitudes, values, habits, beliefs, customs, language, rituals, and ceremonies.<sup>26</sup> A community's culture provides the structure and design for how

individuals live their lives and interpret reality, including their own health. South Asians are a linguistically and religiously diverse population whose behavior is strongly influenced by cultural values.<sup>27,28</sup> Unfortunately, some aspects of this culture have resulted in an increase in the risk of diabetes in an already biologically vulnerable population.

For example, the South Asian diet is rich in fats, sugars, and deep fried foods, which are major contributors to the increased risk of diabetes in this population.<sup>27,29,30</sup> Food plays an important social role for South Asians, and South Asians who are diabetic agree that changing their traditional diet is the most difficult aspect of their care regimen.<sup>28-30</sup> As a result, compliance with reduced sugar and caloric diets tends to be poor.<sup>29,30</sup> Additionally, misconceptions about certain foods, such as "ghor", or brown sugar, being a 'natural' source of sugar and therefore a healthy dietary supplement further exacerbate problems in managing blood glucose levels.<sup>31</sup>

Many societal and religious practices also act as obstacles to effectively manage diabetes in South Asians. For example, strong religious beliefs cause many individuals to develop apathy towards the management of their disease because they feel their

“

**Although diabetes occurrence rates differ across South Asian ethnicities, all exhibit higher prevalence than is seen in Caucasians.**

illness is 'God's will'. These individuals believe they do not have to treat their diabetes because a higher power will look after them.<sup>27,29,32</sup> Some communities have been known to encourage obesity as it is a sign of wealth, prosperity, and good health.<sup>27,32</sup> During specific holidays and festivals, certain South Asian groups practice fasting and pilgrimages followed by massive feasts. These activities often lead to extreme changes in blood glucose levels and complicate diabetes management.<sup>33</sup>

## APPROACH TO MANAGEMENT

Prevention and effective management of the disease are of paramount importance in helping patients lead productive lives without the adverse consequences of diabetes. Preventing obesity and increasing physical activity are of particular importance in South Asians due to their increased insulin insensitivity and additional type 2 diabetes risk factors. The earlier onset of diabetes, increased risk of diabetic complications, and the higher likelihood of developing metabolic syndrome suggest that early diabetic screening of South Asians is essential.<sup>13,34</sup> In addition, further research is required to develop the appropriate pharmacological approach to managing South Asians as it has been shown that their blood glucose levels are difficult to control with conventional treatment.<sup>35</sup>

Several national bodies, including Health Canada and the Canadian Diabetes Association, have drafted recommendations to improve the health outcomes for South Asian diabetics.<sup>36,37</sup>

It is strongly encouraged that Asian-specific BMI and waist circumference (WC) cutoffs should be used to evaluate diabetes risk.<sup>38,39</sup> South Asian individuals with a BMI  $\geq 22$ , or a WC  $\geq 80$ cm for women and  $\geq 90$ cm for men should be considered “at risk” for diabetes.<sup>38,40</sup>

### Culturally Targeted Community Programs

To address the unique needs and complex interplay of culture and genetic predisposition in South Asians, community-based diabetes prevention and management programs should be developed in partnership with the South Asian communities.

For the many distinct South Asian communities, a major barrier to appropriate diabetes screening, care, and education, is a lack of knowledge and understanding of the disease.<sup>29,30,43</sup> Many members of these communities do not regard diabetes as a “serious” disease, and because of health literacy issues and poor English skills, this has proven a difficult attitude to change.<sup>29,30,44</sup> As a consequence, some communities have developed a poor understanding of the link between diabetes and lifestyle factors such as diet and exercise.

Education is an invaluable tool in helping manage diabetes in a population because it can empower patients to improve control of their blood glucose, which in turn reduces their risk of diabetic complications.<sup>45,46</sup> It has been shown that high risk ethnic groups are more likely to participate in diabetes

“  
**...community-based  
 diabetes prevention and  
 management programs should be  
 developed in partnership with the  
 South Asian communities.**

education if the information is presented in a culturally sensitive manner.<sup>41,47</sup> Education sessions are better received if they take place in an informal, relaxed, community environment that allows participants to freely explore topics and questions.<sup>44</sup> A strong understanding of South Asian culture must be the foundation upon which new diabetes programs, policies, and strategies are built. The incorporation of familiar music, clothing, and language has been shown to be effective in educating minorities with respect to health issues.<sup>26</sup> Effective programs have been developed with a strong visual focus as well as with the incorporation of recipes and samples of healthy versions of traditional foods.<sup>48</sup> The use of diabetes awareness days, cooking events, guided shopping, and educational plays have proved to be effective means for providing information to people who would otherwise have difficulty accessing it.<sup>48</sup> It is essential that lifestyle changes not just be conveyed to individuals but rather these practices and healthy habits be embraced by the community as a whole.<sup>31</sup>

### Interprofessional Care Teams

When attempting to control their blood glucose levels,

many patients benefit from the support of interprofessional Diabetes Health Care (DHC) teams.<sup>49-51</sup> At the core of DHC teams are primary care physicians, nurses, and dietitians, and as needed, teams are supported by endocrinologists, social workers, pharmacists, exercise physiologists, ophthalmologists, nephrologists, and podiatrists.<sup>52,53</sup> Education and support through DHC teams has been shown to decrease hemoglobin A1c and cholesterol levels.<sup>54-56</sup> Long-term studies of interprofessional management have shown a reduction in the number of lower limb amputations and a decrease in mortality due to chronic kidney disease.<sup>57,58</sup> Not only is patient self-reported happiness higher with DHC team care, but such integrated programs also have the potential to decrease health care costs.<sup>52,59</sup>

### CONCLUSION

Type 2 diabetes is a serious chronic health concern for South Asians. The increased risk of diabetes may be associated with several factors, including genetic predisposition, in-utero metabolic factors, and cultural practices. In light of this increased risk, it is important to provide an interprofessional approach to management. This may include sufficient education that takes into consideration cultural practices and development of a therapeutic plan. 

### REFERENCES

1. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract.* 2009 Nov 5;87(1):4-14.
2. Economic costs of diabetes in the U.S. In 2007. *Diabetes Care* 2008 Mar;31(3):596-615.
3. Alberti KG, Zimmet PZ. Definition, diagnosis and classification of diabetes mellitus and its complications. Part 1: diagnosis and classification of diabetes mellitus provisional report of a WHO consultation. *Diabet Med.* 1998 Jul;15(7):539-53.
4. Adegbate E, Schattner P, Dunn E. An update on the etiology and epidemiology of diabetes mellitus. *Ann N Y Acad Sci.* 2006 Nov 28;1084:1-29.
5. Bhopal R, Unwin N, White M, Yallop J, Walker L, Alberti KG, *et al.* Heterogeneity of coronary heart disease risk factors in Indian, Pakistani, Bangladeshi, and European origin populations: Cross sectional study. *BMJ.* 1999 Jul 24;319(7204):215-20.
6. Mather HM, Keen H. The Southall Diabetes Survey: Prevalence of known diabetes in Asians and Europeans. *Br Med J (Clin Res Ed).* 1985 Oct 19;291(6502):1081-4.
7. Karter AJ, Ferrara A, Liu JY, Moffet HH, Ackerson LM, Selby JV. Ethnic disparities in diabetic complications in an insured population. *JAMA.* 2002 May 15;287(19):2519-27.
8. Venkataraman R, Nanda NC, Baweja G, Parikh N, Bhatia V. Prevalence of diabetes mellitus and related conditions in Asian Indians living in the United States. *Am J Cardiol.* 2004 Oct 1;94(7):977-80.
9. Anand SS, Yusuf S, Vuksan V, Devanesen S, Teo KK, Montague PA, *et al.* Differences in risk factors, atherosclerosis, and cardiovascular disease between ethnic groups in Canada: The study of health assessment and risk in ethnic groups (SHARE). *Lancet.* 2000 Jul 22;356(9226):279-84.
10. Verma NP, Mehta SP, Madhu S, Mather HM, Keen H. Prevalence of known diabetes in an urban Indian environment: The Darya Ganj diabetes survey. *Br Med J (Clin Res Ed).* 1986 Aug 16;293(6544):423-4.
11. Mohan V, Deepa M, Deepa R, Shanthirani CS, Farooq S, Ganesan A, *et al.* Secular trends in the prevalence of diabetes and impaired glucose tolerance in urban South India--the Chennai urban rural epidemiology study (CURES-17). *Diabetologia.* 2006 Jun;49(6):1175-8.
12. Mukhopadhyay B, Forouhi NG, Fisher BM, Kesson CM, Sattar N. A comparison of glycaemic and metabolic control over time among South

- Asian and European patients with type 2 diabetes: Results from follow-up in a routine diabetes clinic. *Diabet Med.* 2006 Jan;23(1):94-8.
13. Whincup PH, Gilg JA, Papacosta O, Seymour C, Miller GJ, Alberti KG, *et al.* Early evidence of ethnic differences in cardiovascular risk: Cross sectional comparison of British South Asian and white children. *BMJ.* 2002 Mar 16;324(7338):635.
  14. Ehtisham S, Crabtree N, Clark P, Shaw N, Barrett T. Ethnic differences in insulin resistance and body composition in United Kingdom adolescents. *J Clin Endocrinol Metab.* 2005 Jul;90(7):3963-9.
  15. McKeigue PM, Shah B, Marmot MG. Relation of central obesity and insulin resistance with high diabetes prevalence and cardiovascular risk in South Asians. *Lancet.* 1991 Feb 16;337(8738):382-6.
  16. Banerji MA, Faridi N, Atluri R, Chaiken RL, Lebovitz HE. Body composition, visceral fat, leptin, and insulin resistance in Asian Indian men. *J Clin Endocrinol Metab.* 1999 Jan;84(1):137-44.
  17. Mather HM, Chaturvedi N, Fuller JH. Mortality and morbidity from diabetes in South Asians and Europeans: 11-year follow-up of the Southall Diabetes Survey, London, UK. *Diabet Med.* 1998 Jan;15(1):53-9.
  18. McKeigue PM, Ferrie JE, Pierpoint T, Marmot MG. Association of early-onset coronary heart disease in South Asian men with glucose intolerance and hyperinsulinemia. *Circulation.* 1993 Jan;87(1):152-61.
  19. Kain K, Catto AJ, Grant PJ. Associations between insulin resistance and thrombotic risk factors in high-risk South Asian subjects. *Diabet Med.* 2003 Aug;20(8):651-5.
  20. Hales CN, Barker DJ. Type 2 (non-insulin-dependent) diabetes mellitus: The thrifty phenotype hypothesis. *Diabetologia.* 1992 Jul;35(7):595-601.
  21. McCance DR, Pettitt DJ, Hanson RL, Jacobsson LT, Knowler WC, Bennett PH. Birth weight and non-insulin dependent diabetes: Thrifty genotype, thrifty phenotype, or surviving small baby genotype? *BMJ.* 1994 Apr 9;308(6934):942-5.
  22. Singhal A, Wells J, Cole TJ, Fewtrell M, Lucas A. Programming of lean body mass: A link between birth weight, obesity, and cardiovascular disease? *Am J Clin Nutr.* 2003 Mar;77(3):726-30.
  23. Neel JV. Diabetes mellitus: A "thrifty" genotype rendered detrimental by "progress"? 1962. *Bull World Health Organ.* 1999;77(8):694-703; discussion 692-3.
  24. Abate N, Chandalia M, Satija P, Adams-Huet B, Grundy SM, Sandeep S, *et al.* ENPP1/PC-1 K121Q polymorphism and genetic susceptibility to type 2 diabetes. *Diabetes.* 2005 Apr;54(4):1207-13.
  25. Chandak G, Janipalli C, Bhaskar S, Kulkarni S, Mohankrishna P, Hattersley A, *et al.* Common variants in the TCF7L2 gene are strongly associated with type 2 diabetes mellitus in the Indian population. *Diabetologia.* 2007;50(1):63-7.
  26. Jack Jr L, Liburd L, Spencer T, Airhihenbuwa C. Understanding the environmental issues in diabetes self-management education research: A reexamination of 8 studies in community-based settings. *Ann Intern Med.* 2004;140(11):964.
  27. Naeem AG. The role of culture and religion in the management of diabetes: A study of Kashmiri men in Leeds. *J R Soc Promot Health.* 2003 Jun;123(2):110-6.
  28. Ikeda J. Culture, food, and nutrition in increasingly culturally diverse societies. In Germov J, Williams L. *A sociology of food and nutrition.* Oxford, New York: Oxford University Press. 1999:149-68.
  29. Stone M, Pound E, Pancholi A, Farooqi A, Khunti K. Empowering patients with diabetes: A qualitative primary care study focusing on South Asians in Leicester, UK. *Fam Pract.* 2005 Dec;22(6):647-52.
  30. Baradaran H, Knill-Jones R. Assessing the knowledge, attitudes and understanding of type 2 diabetes amongst ethnic groups in Glasgow, Scotland. *Pract Diab Int.* 2004;21(4):143-7.
  31. Patel V, Morrissey J, Goenka N, James D, Shaikh S. Diabetes care in the Hindu patient: Cultural and clinical aspects. *Br J Diabetes Vasc Dis.* 2001;1(2):132.
  32. Greenhalgh T, Helman C, Chowdhury A. Health beliefs and folk models of diabetes in British Bangladeshis: a qualitative study. *Br Med J.* 1998;316(7136):978.
  33. Shaikh S, James D, Morrissey J, Patel V. Diabetes care and Ramadan: To fast or not to fast. *Br J Diabetes Vasc Dis.* 2001;1:65-7.
  34. Ramachandran A, Snehalatha C, Vijay V, Colagiuri S. Detecting undiagnosed diabetes in urban Asian Indians-role of opportunistic screening. *JAPI.* 2004;52:545-6.
  35. O'Hare JP, Raymond NT, Mughal S, Dodd L, Hanif W, Ahmad Y, *et al.* Evaluation of delivery of enhanced diabetes care to patients of South Asian ethnicity: The United Kingdom Asian diabetes Study (UKADS). *Diabet Med.* 2004 Dec;21(12):1357-65.
  36. Harvey E, Harris S, Sohal P. Type 2 diabetes in high-risk ethnic populations. *Can J Diabetes.* 2008;Volume 32(Supplement 1):S191-S3.
  37. Meltzer S, Leiter L, Daneman D, Gerstein H, Lau D, Ludwig S, *et al.* 1998 Clinical practice guidelines for the management of diabetes in Canada. *CMAJ.* 1998;159:1-29.
  38. Alberti KG, Zimmet P, Shaw J. Metabolic syndrome--a new world-wide definition. A consensus statement from the International Diabetes Federation. *Diabet Med.* 2006 May;23(5):469-80.
  39. Appropriate body-mass index for Asian populations and its implications for policy and intervention strategies. *Lancet.* 2004 Jan 10;363(9403):157-63.
  40. Patel JK, Hughes EA, Mackness MI, Vyas A, Cruickshank JK. Appropriate body-mass index for Asians. *Lancet.* 2003 Jan 4;361(9351):85.
  41. Garvin C, Cheadle A, Chrisman N, Chen R, Brunson E. A community-based approach to diabetes control in multiplecultural groups. *Ethn Dis.* 2004;14.
  42. Davachi S, Flynn MAT, Edwards AL. A health region/community partnership for type 2 diabetes risk factor screening in Indo-Asian communities. *Can J Diabetes.* 2005;29(2):87-94.
  43. Ford S, Mai F, Manson A, Rukin N, Dunne F. Diabetes knowledge--are patients getting the message? *Int J Clin Pract.* 2000 Oct;54(8):535-6.
  44. Vyas A, Haidery AZ, Wiles PG, Gill S, Roberts C, Cruickshank JK. A pilot randomized trial in primary care to investigate and improve knowledge, awareness and self-management among South Asians with diabetes in Manchester. *Diabet Med.* 2003 Dec;20(12):1022-6.
  45. Hawthorne K. Effect of culturally appropriate health education on glycaemic control and knowledge of diabetes in British Pakistani women with type 2 diabetes mellitus. *Health Educ Res.* 2001 Jun;16(3):373-81.
  46. Simmons D. Diabetes self help facilitated by local diabetes research: the Coventry Asian Diabetes Support Group. *Diabet Med.* 1992 Nov;9(9):866-9.
  47. Sanghara R. Deterrents of participation in diabetes education: Perspectives of elderly Indo-Canadians. *Can J Diabetes.* 2000;24(1):19-26.
  48. Coughlan Y, RGN B. Diabetes Fairs: Bromley by Bow Healthcentre. A holistic approach to diabetes care in the community. *Pract Diab Int.* 2005;22(6):197-201.
  49. Clement S. Diabetes self-management education. *Diabetes Care.* 1995;18(8):1204.
  50. Dunn S, Huskins P, M Constantino ea. Diabetic management: the role of the diabetes center. *Diabetes Rev.* 1994(2):389-402.
  51. Greenhalgh P. Shared care for diabetes: A systematic review. Occasional paper (Royal College of General Practitioners). 1994;(67).
  52. Janson S, Cooke M, McGrath K, Kroon L, Robinson S, Baron R. Improving chronic care of type 2 diabetes using teams of interprofessional learners. *Acad Med.* 2009;84(11):1540.
  53. Pollom R, Pollom R. Utilization of a multidisciplinary team for inpatient diabetes care. *Crit Care Nurs Q.* 2004;27(2):185.
  54. Lin D, Hale S, Kirby E. Improving diabetes management: Structured clinic program for Canadian primary care. *Can Fam Physician.* 2007;53(1):73.
  55. Kaufman F, Halvorson M, Carpenter S. Association between diabetes control and visits to a multidisciplinary pediatric diabetes clinic. *Pediatrics.* 1999;103(5):948.
  56. Shojania K, Ranji S, McDonald K, Grimshaw J, Sundaram V, Rushakoff R, *et al.* Effects of quality improvement strategies for type 2 diabetes on glycemic control: A meta-regression analysis. *Jama.* 2006;296(4):427.
  57. Krishnan S, Nash F, Baker N, Fowler D, Rayman G. Reduction in diabetic amputations over 11 years in a defined UK population. *Diabetes Care.* 2008;31(1):99.
  58. Hemmelgarn B, Manns B, Zhang J, Tonelli M, Klarenbach S, Walsh M, *et al.* Association between multidisciplinary care and survival for elderly patients with chronic kidney disease. *J Am Soc Nephrol.* 2007;18(3):993.
  59. Scanlon D, Hollenbeak C, Beich J, Dyer A, Gabbay R, Milstein A. Financial and clinical impact of team-based treatment for Medicaid enrollees with diabetes in a federally qualified health center. *Diabetes Care.* 2008;31(11):2160.

# Treatment Modalities and the Neuropathology of Palmar Hyperhidrosis

Mark S. Ballard, BSc (Co-Op)<sup>a</sup>, G.R. Wayne Moore, MD<sup>b</sup>, Thomas J. Zwimpfer, MD<sup>b</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2010, Faculty of Medicine, University of British Columbia, Vancouver, BC

<sup>b</sup>Faculty of Medicine, University of British Columbia, Vancouver, BC

## ABSTRACT

Palmar Hyperhidrosis (PHH) is a largely idiopathic condition that leads to significant dermatological and socio-professional concerns. This article reviews the method of treating PHH and defines the role of the neuropathologist, which is poorly illustrated in current literature. PHH is treated with the stepwise use of aluminum salts, iontophoresis, Botox injections, systemic drugs and finally endoscopic thoracic sympathectomy (ETS). ETS is currently saved for medically refractory PHH and the procedure is being optimized. Currently consideration is being given to whether the T2 vs. the T2 T3 T4 ganglia should be excised or whether they should be reversibly clamped or permanently excised. Although during ETS the surgeon can correctly identify the ganglion, the pathologist still plays a role in studying the histopathology to gain further understanding of the pathophysiology of PHH. Some of the pathohistological changes that may be observed in the PHH ganglia include neuronal cell death, lipofuscin accumulation, and inflammation. At present the relationship of these findings to the clinical presentation and pathogenesis of PHH is unclear, and without an animal model, research will be slow. Thus, the neuropathologist and surgeon should take special note of the clinical picture and correlate the number of pathohistological findings with the degree of clinical symptoms. Finally, the neuropathologist may assess the type of inflammation (i.e. monocytic vs. lymphocytic) via immunohistochemical stains and continue the search for non-documented and undiscovered pathohistologic markers of PHH.

**KEYWORDS:** hyperhidrosis, sympathectomy, pathology, treatment, ganglia, ganglion

## INTRODUCTION

Hyperhidrosis (HH) may be recognized as excessive sweating beyond the quantity needed for temperature control.<sup>1</sup> It affects 2.8% of the general population and can be classified as either generalized or focal. Generalized HH, or HH of a body surface greater than 100 cm<sup>2</sup>, is largely secondary to primary medical conditions (see Table 1).<sup>2</sup> On the other hand focal HH, or HH of a body surface less than 100 cm<sup>2</sup>, is largely idiopathic and affects the axillae (40%), the hands and feet (40%), and other areas such as the forehead and groin. Given that focal HH is largely idiopathic, this review will not focus on secondary causes. Focal HH may have a serious impact on a patient's psychosocial and professional life – for example, shaking others' hands or holding tools.<sup>3</sup> Furthermore, HH left untreated can trigger a variety of dermatological conditions (see Table 2).<sup>2,4</sup> The purpose of this review is to highlight the current treatment strategy for PHH and to focus on the role of histopathology, which is not well defined in the current literature.

## PERIPHERALLY TARGETED TREATMENTS

PHH is predominantly a disorder of the eccrine sweat glands.<sup>1</sup> Sweat glands can be broken down into apocrine and eccrine sweat glands. The apocrine

**Table 1.** Classifications and etiologies of focal and generalized hyperhidrosis.

Focal HH		Generalized HH
Primary	Secondary	System Etiologies
Armpits	Gustative HH	Biochemical
Hands		Endocrine
Feet		Neoplastic
Forehead		Neurological
Scalp		Night Sweats
Groin		Traumatic
Genitals		Other

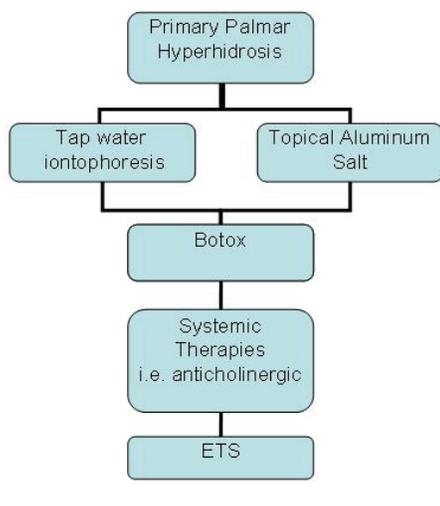
**Table 2.** Dermatological conditions secondary to untreated PHH.

Bacterial infections
Callosity
Candidiasis
Dermatitis
Dyshidrotic eczema
Erythrasma
Friction bubbles
Frostbite
Ingrown nails
Intertrigo
Onychomycosis
Pitted keratolysis
Tinea pedis
Tinea versicolore
Trichomycosis axillaris
Warts

## Correspondence

Mark S. Ballard, cerebral\_nuclei@hotmail.com

Progression  
of treatment  
for refractory  
PHH



**Figure 1.** Treatment algorithm for PHH.

sweat glands are predominantly located in the axillae and the groin and have a role in production of body odor. On the other hand, the eccrine sweat glands are primarily involved in thermoregulation and are located throughout the body. The eccrine sweat gland is made of a spiral duct called the acrosyringium, which opens up to the skin and is located within the epidermis. It also has a straight dermal portion and a coiled secretory part called the acinar portion located within the dermis or hypodermis.<sup>5</sup>

Patients with PHH can be treated via a stepwise approach based on the severity of their symptoms (see Figure 1).<sup>3</sup> Current literature recommends the use of a 40% aluminum chloride hexahydrate (ACH) in salicylic acid gel (SAG) as a first line agent. The patient should wait a period of one month to assess the effectiveness of treatment. If excessive dryness develops, the clinician may lower the concentration of ACH to 30%. If the initial ACH treatment is ineffective, the clinician may increase the concentration of ACH to 55%.<sup>3,6</sup> ACH reduces sweat by destroying luminal epithelium, causing mechanical obstruction of the eccrine duct at the level of the acrosyringium.<sup>7,8</sup>

As a second line therapy, the clinician can consider tap-water iontophoresis.<sup>3</sup> Iontophoresis is a non-invasive method of propelling bioactive ionically-charged substances transdermally by using an electromotive force generated from small electric charge interactions.<sup>9</sup> Some PHH authorities speculate that the electric charge generated causes the stratum corneum to thicken and subsequently block the sweat glands.<sup>10,11</sup>

Failure of both ACH and iontophoresis should lead the clinician to consider botulinum toxin type A injections (Botox).<sup>3</sup> Although Botox is easier to use for axillary HH as there is no anesthesia required, it can also be used for palmar and sole HH with anesthesia. Botox works by inhibiting the release of acetylcholine from the nerve terminal, thus preventing transmission of the signal to the M3 receptor of the sweat gland. Botox injections do present with some potential complications.<sup>11,12</sup> First is the issue of the local anesthesia prior to palmar nerve block as repeated needle

“

## Focal HH may have a serious impact on a patient's psychosocial and professional life...

injections do risk damaging the nerve. Second, repeated Botox injections are costly and can also lead to immuno-resistance. Third, Botox can periodically lead to transient paralysis of the hand.<sup>13</sup>

Some literature also describes the use of anticholinergics to inhibit the sweat gland's M3 receptor. There is a randomized, placebo-controlled, double blinded study showing a positive effect of methanethelinium bromide for axillary HH but not palmar HH.<sup>14</sup> However the use of anti-cholinergics has been limited due to their side effects such as dry mouth, accommodation disorders, urinary retention, constipation, and memory impairment. The successful use of benzodiazepines, antidepressants, and calcium channel blockers has also been described in case studies.<sup>5</sup>

## SYMPATHETIC SYSTEM TARGETED TREATMENTS

The eccrine gland-targeted nerve signal can stem from either the peripheral or the central nervous system.<sup>15</sup> Central mechanisms of sweating stem from the hypothalamus where all of the thermosensory afferents are integrated.<sup>16</sup> As the core body temperature increases, the hypothalamus acts to decrease this temperature by cutaneous vasodilation and sweating.<sup>17,20</sup> Hormones, oxygen saturation, and emotions also all influence sweating through various neurological centers including the amygdala, prefrontal cortex, insular cortex, and cingulum.<sup>5,21</sup>

Peripherally, the sweat glands are innervated by the sympathetic nervous system, which can be broken down into the adrenergic preganglionic fibres and the postganglionic fibers. The postganglionic sympathetic C fibers, which release acetylcholine onto the M3 receptors of the eccrine glands, are the targets for PHH treatment directed at the sympathetic nervous system.<sup>22</sup>

Over the last several decades, sympathectomy has been employed as a treatment for medically refractory PHH.<sup>5</sup> During the 1990s, advancement in endoscopic techniques allowed the surgeon to approach the sympathetic chain through a small incision. The endoscopic thoracic sympathectomy (ETS) of T2 T3 is successful at reducing PHH in almost 98% of all cases.<sup>23</sup> All patients will experience compensatory sweating, as there is decreased sympathetic tone to the head, which triggers an increase in total body sweat to regulate temperature at a new set point. The amount of compensatory sweating depends on the patient, the damage that the white rami communicans incurs, and the amount of cell body reorganization in the spinal cord after surgery.<sup>24</sup> Studies have shown that the number of patients experiencing compensatory sweating can be further decreased in two ways: first, by reversibly clamping the sympathetic chain as opposed to destroying or cutting it and second, by clamping at the T2 level only instead of clamping at the T2 T3 T4 level.<sup>23,25,26</sup> Other potential complications include inadequate resection of the

The *University of British Columbia Medical Journal (UBCMJ)* is a student-run academic journal with a goal to engage students in dialogue in medicine. Our scope ranges from original research and review articles in medicine to medical trends, clinical reports, elective reports, and commentaries on the principles and practice of medicine. We strive to maintain a high level of integrity and accuracy in our work, to encourage collaborative production and cross-disciplinary communication, and to stimulate critical and independent thinking.

## SUBMISSION GUIDELINES

Articles are submitted online (<http://ojs.library.ubc.ca/index.php/ubcmj>) via our online submissions system, OJS. Please refer to the complete online version of the UBCMJ Guide to Authors which can be found at [www.ubcmj.com](http://www.ubcmj.com).

## AUTHOR ELIGIBILITY

Authors must acknowledge and declare any sources of funding or potential conflicting interest, such as receiving funds or fees by, or holding stocks and benefiting financially from, an organization that may profit or lose through publication of the submitted paper.

## FORMATTING CRITERIA

Formatting should conform strictly with the ICMJE Uniform Requirements for Manuscripts Submitted to Biomedical Journals (<http://www.download.thelancet.com/flatcontentassets/authors/icmje.pdf>), also known as the Vancouver Style. Manuscripts should be submitted as Microsoft Word 97-2003 documents and written in clear, grammatical English, with 12-point font and double-spaced formatting. Manuscript pages must be numbered consecutively with the title page constituting page 1 and include continuous line numbers. All identifying information from the manuscript must be removed.

**All articles should be submitted by the primary author and should contain the following:**

### Cover Letter

All submissions should be accompanied with a cover letter including complete correspondence information for the primary author. Please see [www.ubcmj.com](http://www.ubcmj.com) for full details.

## Manuscript

No author identifying information should appear in any place within the manuscript. Identifying information may compromise the peer review process. Author information appearing anywhere in the manuscript may cause the manuscript to be returned for further editing.

## Title Page

The title page should constitute the first page of the manuscript and include only the title of the manuscript.

## Abstract

The abstract should provide a comprehensive, accessible summary of the material presented in the article and should avoid abbreviations. All submissions require abstracts with the exception of News, Letters to the Editor, and Research Letters.

## Organization

The article should be clearly organized with an appropriate introduction, development, and conclusion. Longer articles should consider incorporating subheadings for more appropriate formatting.

## Tables, Figures, and Graphics

Authors are responsible for obtaining permission to use any tables, illustrations, or figures adapted from other sources. Tables may be included at the end of the manuscript or as separate files. All tables and figures must be accompanied by a number as referenced in the text, title and caption, and should explain all abbreviations used. Please refer to [www.ubcmj.com](http://www.ubcmj.com) for detailed instructions.

## Word Limits

Please refer to the UBCMJ Guide to Authors found [www.ubcmj.com](http://www.ubcmj.com) for specific word limits for each section.

## References

Authors are responsible for the accuracy of references cited within the manuscript. References should follow the order in which they appear in the text. References must adhere to the Vancouver style. More details can be found at [www.ubcmj.com](http://www.ubcmj.com).

## Drug Names

Both generic and trade names should be provided for all drugs, with the generic name in lower-case and the commercial name in parentheses and with a first letter in upper case. Drugs not yet available in Canada should be so noted.

## SPECIFIC SUBMISSION CRITERIA

### Academic Research

Research articles report student-driven research projects and succinctly describe findings in a manner appropriate for a general medical audience. The articles should place findings in the context of current literature in their respective disciplines. Please contact the Academic Editors at [academic@ubcmj.com](mailto:academic@ubcmj.com) for more information.

**Full Length Articles** should be divided into the subheadings Introduction, Materials and Methods, Results, Discussion, Acknowledgements (if any), References, Disclaimers (if any). Each full length article must include a structured abstract and keywords.



**Research Letters** summarize research of a shorter length and depth. These do not require extensive elaborations regarding methods or results. No abstract is required for research letters.

**Disclosure Agreements**

If you acknowledge anyone for a contribution that goes beyond administrative assistance, you must obtain written permission from that person to publish his or her name. Please refer to [www.ubcmj.com](http://www.ubcmj.com) for more information.

**Reviews**

Reviews provide an overview of a body of scientific work or a medical trend. Reviews may outline a current medical issue or give insight into the principles of practice of a clinical field. Authors may choose to review the etiology, diagnosis, treatment, or epidemiology of a specific disease. Articles may also provide a survey of literature dealing with philosophy or social sciences. Please contact the Reviews Editors at [reviews@ubcmj.com](mailto:reviews@ubcmj.com) for more information.

**Global Health**

This section deals with specific experiences or issues in global health; these generally fit into the WHO definition of global health as “the health of populations in a global context that transcends the perspectives and concerns of individual nations.” Articles should reflect on current or historical issues of international relevance. Articles should correspond to one of the following formats:

1. Editorials are well-researched submissions that outline a current or historical global health issue or expose and explore aspects of global health.
2. Reflections are subjective, anecdotal pieces of personal insight upon a global health related issue.
3. Dispatches are brief articles that offer a perspective on a specific global health experience.

Please contact the Global Health Editors at [global.health@ubcmj.com](mailto:global.health@ubcmj.com) for more information.

**News and Letters**

Abstracts are not required for News and Letters submissions. There are two main types of submissions:

1. UBCMJ looks for breaking news within the medical community.
2. Letters to the Editor are meant for readers to express their opinion in response to any articles published in past issues of the *UBCMJ*.

For submitting a news lead or for writing assignments, please contact the News & Letters Editors at [news@ubcmj.com](mailto:news@ubcmj.com).

**Commentaries**

The aim of this section is to provide a platform for intellectual dialogue on topics relevant to the study and practice of medicine. Articles submitted to this section should correspond to one of the following descriptions. An abstract is required.

1. Subjective pieces relevant to medical studies, life as a future physician, or the current social context of medicine.
2. An article that highlights the significance of an interesting research study or area from a clinical perspective.
3. Book Reports are brief reports that feature a non-fiction or fiction work and explain its significance and context in the practice and study of medicine.

Please contact the Commentaries Editors at [commentaries@ubcmj.com](mailto:commentaries@ubcmj.com) for more information.

**Careers**

Career pieces discuss issues of interest to medical students related to professional

development. Pieces can present a biographical look at the life of a prominent physician through interview, discuss the residency application process and specialty selection, or other related topics of interest.

Please contact the News & Letters Editors at [news@ubcmj.com](mailto:news@ubcmj.com) for more information.

**Case and Elective Reports**

Case Reports describe notable clinical encounters with patients in a public health setting. The case should provide a relevant teaching point for medical students.

**Patient consent**

Submissions must include consent from the patient in order to be considered for publication. A copy of the written consent obtained from the patient must accompany the submission.

**SOAP note**

In addition to the standard submission criteria, case reports are strongly encouraged to include a brief inset summarizing the findings in the form of a standard medical history SOAP note (Subjective, Objective, Assessment, Plan).

Elective Reports aim to increase student exposure to a variety of medical specialties and training opportunities both locally and internationally. Reports give a specific description of the scope of a practice in a medical specialty and/or training program and recall a student’s impressions and reflections during and upon completion of the elective. They should highlight the student’s clinical experiences and the unique features offered by the program. Examples of Elective Reports can be found at the Lancet Student (<http://www.thelancetstudent.com/category/electives/>).

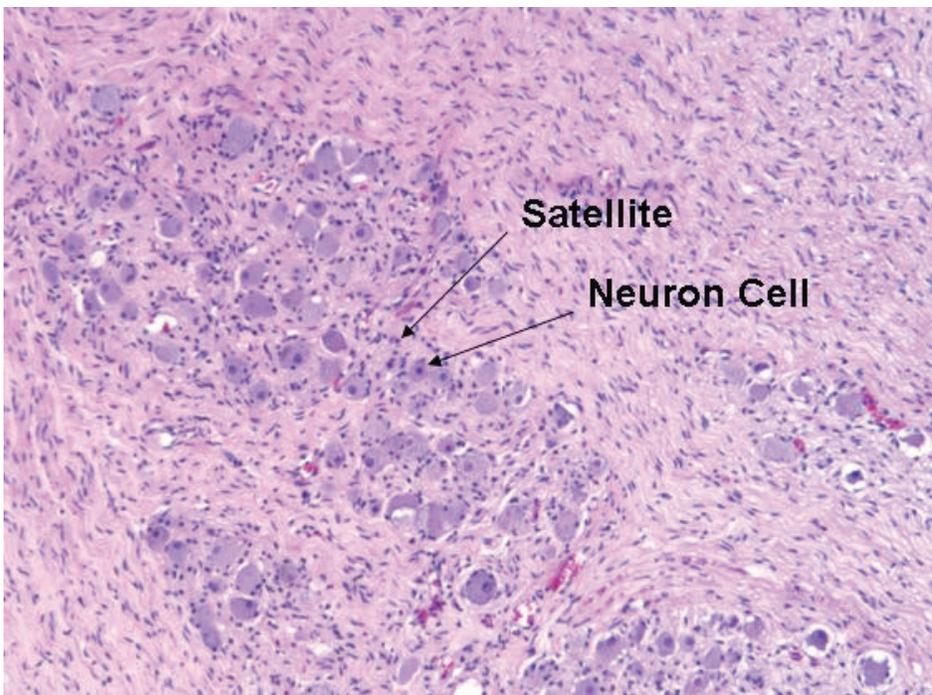
Please contact the Case Report Editors at [reports@ubcmj.com](mailto:reports@ubcmj.com) for more information.

ganglia, gustatory sweating, pneumothorax, cardiac dysfunction, post-operative pain, and finally Horner's syndrome secondary to resection of the stellate ganglion.<sup>27</sup>

## NEUROPATHOLOGY

In ETS, the T2 ganglion is adequately and precisely visualized and excised from the sympathetic chain by the surgeon. However, to aid current research efforts in trying to understand the pathophysiology of PHH, the tissue should still be examined by a neuropathologist. To examine the ganglion's neuropathology one does need to be familiar with the normal anatomy and histology of the sympathetic nervous system. The sympathetic ganglia can be separated into two different groups: the paravertebral (next to the vertebrae) and the prevertebral (in front of the vertebrae). The prevertebral ganglia provide sympathetic innervation to the internal organs whereas the paravertebral ganglia provide innervation to the skin surface and the eccrine glands. The paravertebral ganglia lie bilaterally along the dorsal wall of the thorax from C1 to S2 with one pair of ganglia per spinal cord level.<sup>28</sup>

A sympathetic efferent pathway typically consists of two networked neurons. The first neuron, the cholinergic preganglionic neuron, is in the intermediolateral cell column of the spinal cord grey matter. It sends its axon to synapse with a multipolar neuron, typically an adrenergic postganglionic neuron in a paravertebral ganglion. In the case of a sweat gland, the postganglionic neuron is cholinergic and innervates the M3 receptor in the gland. The postganglionic axons leave the ganglion via the ventral roots through the white rami communicans at varying spinal levels where they travel to their target organ, in this case the eccrine glands.<sup>28</sup>



**Figure 2.** Histological appearance of a normal ganglion stained with hematoxylin and eosin. Neuron cell bodies and satellite cells are indicated. Note the size and quantity of satellite cells vs. neurons. Given the poor understanding of PHH and lack of photos of PHH-related ganglia only a normal photo is included in this article.

The ganglion containing the postganglionic cell body histologically consists of neuron cell bodies, satellite cells, and axons (see Figure 2). The ganglion cells generally have a diameter of 10 to 50  $\mu\text{m}$  and are multipolar with multiple dendrites and a long axon that exits the ganglion. The multipolar cell dendrites are of variable length and periodically form “dendritic glomeruli” with adjacent cells. Surrounding the neurons is a multitude of satellite cells that form a contiguous sheath with the Schwann cells of the peripheral nervous system.<sup>29</sup>

In a review of the literature of the histopathological changes of postganglionic cells in individuals with PHH, one article was found. In a study of 55 post-sympathectomy ganglia of 35 individuals with a mean age of 29 years, researchers found an increase in neuronal death and lipofuscin accumulation as compared to expected levels (i.e. 60% of biopsies contained significant lipofuscin accumulation and chromatolysis).<sup>30</sup> These results were acquired by assigning a value to the fraction of the biopsy affected (i.e. where 75% of a biopsy containing lipofuscin or neuronal death was considered significant and assigned a value of 2; a biopsy with 25%-75% was assigned a value of 1; and a biopsy with less than 25% was insignificant and assigned a value of 0). The value was then compared to literature descriptions of normal sympathetic ganglia in mice, rats, and rabbits as there is no known normal value in humans. Further, only 5.5% of the biopsies contained any inflammation in the form of swelling, and no further marker of inflammation was assessed. Thus, chromatolysis and lipofuscin were independent of inflammation in 32.1% of cases.

From the results of this article and the young age of the patients affected by PHH, the authors postulated that the neuronal changes could be secondary to neuronal hyperstimulation.<sup>30</sup> It was noted that patients who received a sequential bilateral sympathectomy separated by a period of months experienced a decrease in the number of ganglia exhibiting significant neuron death from 71% in the first surgery to 42% in the second. Thus, a unilateral sympathectomy of T2 T3 provided protection, through an unknown mechanism, to the contralateral ganglion's neurons. This same study noted that the larger the body area de-innervated by ETS, the higher the incidence of compensatory hyperhidrosis.<sup>30</sup> Removal of bilateral ganglia would result in upward of 79% of patients suffering from compensatory hyperhidrosis vs. 56% for a unilateral ETS.

A second research group described the role of histopathology in the sympathectomy to verify that two ganglia and an interconnecting peripheral nerve were excised.<sup>31</sup> Thus the histopathology confirmed that the surgeon alone could excise the ganglion with a success rate of surgery at 98%. Additionally this article noted that excision of the lower third of the stellate ganglia – as identified surgically – increased the rate of Horner's syndrome.<sup>32</sup>

“

...to aid current research efforts in trying to understand the pathophysiology of PHH, the tissue should still be examined by a neuropathologist.

## CONCLUSION

PHH is a medical condition leading to a wide range of dermatological conditions and socio-professional issues. In medically refractory PHH, the surgeon identifies and diagnoses the ganglion during ETS and then excises it intraoperatively with a success rate of 98%. The pathologist confirms that the removed tissue is a ganglion, but this is not required for the diagnosis. The main role of histopathology in ETS is to further the current knowledge of the pathophysiology of PHH.

At this point very little research exists on the relationship of the histopathology of ganglia in PHH to its pathophysiology, but the existing literature does raise its own questions. As noted, individuals begin to suffer from PHH at a mean age of 29, which is considered very young for disease states. This begs the question, is there hyperstimulation of the sympathetic ganglion leading to cell death? At present there is no research, but animal models could be employed to test whether an increase in the frequency, duration, or volume of stimulation over time has any effect on the sympathetic ganglia. Furthermore, animal models could also be employed to investigate why a unilateral sympathectomy for PHH is protective to the contralateral side's neurons, which was excised at a later date after a second ETS. Unfortunately, as there is no animal model of PHH, these hypotheses may be difficult to test. Without an active animal model for PHH, research into this field will continue to rely on case reports and histopathology with related clinical correlations.

The role of the neuropathologist is to document carefully the amount of lipofuscin, neuronal death, and inflammation observed in addition to any findings not previously reported as correlating to PHH. In recording the degree of inflammation the pathologist may use immunohistochemical stains to further illustrate the type of inflammation, namely whether it is lymphocytic or monocytic. Furthermore, the neuropathologist and surgeon should take special note of the clinical picture and correlate the number of pathohistological findings with the degree of clinical symptoms. Appropriately documenting these correlations will assist future researchers in correlating more findings and generating a greater understanding of PHH. 

## ACKNOWLEDGEMENTS

The authors wish to thank Dr. Benohanian for his support in providing the summary charts for PHH that allowed for the creation of Tables 1 & 2.

## REFERENCES

1. Benohanian A. Palmar hyperhidrosis: A condition with unsuspected psychosocial and professional repercussions. *Patientcare*. 2007;22-27.
2. Naumann M, Jost W. Botulinum toxin treatment of secretory disorders. *Mov Disord*. 2004;19(Suppl 8):S137-S141.

3. Benohanian A, Boudjikian A, Paylan Y. Palmar and plantar hyperhidrosis: a practical management algorithm. *Therapy*. 2007;4(3):279-283.
4. Benohanian A. Antiperspirants and deodorants. *Clin Dermatol*. 2001;19(4):398-405.
5. Schlereth T, Dieterich M, Birklein F. Hyperhidrosis--Causes and treatment of enhanced sweating. *Dtsch Arztebl Int*. 2009;106(3):32-37.
6. Tögel B, Greve B, Raulin, C. Current therapeutic strategies for hyperhidrosis: a review. *Eur J Dermatol*. 2002;12(3):219-223.
7. Hölzle E, Braun-Falco O. Structural changes in axillary eccrine glands following long-term treatment with aluminium chloride hexahydrate solution. *Br J Dermatol*. 1984;110(4):399-403.
8. Reller HH, Lueders WL. Pharmacologic and toxicologic effects of topically applied agents on the eccrine sweat glands. *Advances in Modern Toxicology, Dermatotoxicology and Pharmacology*. Hemisphere Publishing Co., Washington USA. 1977;4(18):1-59.
9. Anliker MD, Kreyden OP. Tap water iontophoresis. *Curr Probl Dermatol*. 2002;30:48-56.
10. Hölzle E. Topical pharmacological treatment. *Curr Probl Dermatol*. 2002;30:30-43.
11. Moraru E, Auff E, Schneider P. Hyperhidrosis of the palms and soles. *Curr Probl Dermatol*. 2002;30:156-169.
12. Lowe N, Campanati A, Bodokh I, Cliff S, Jaen P, Kreyden O, Naumann M, Offidani A, Vadoud J, Hamm H. The place of botulinum toxin type A in the treatment of focal hyperhidrosis. *Br J Dermatol*. 2004;151:1115-1122.
13. Hayton MJ, Stanley JK, Lowe NJ. A review of peripheral nerve blockade as local anaesthesia in the treatment of palmar hyperhidrosis. *Br J Dermatol*. 2003;149(3):447 - 451.
14. Hund M, Sinkgraven R, Rzany B. Randomisierte, plazebokontrollierte klinische Doppelblindstudie zur Wirksamkeit und Verträglichkeit der oralen Therapie mit Methanethelinumbromid (Vagantin) bei fokaler Hyperhidrose. *J Dtsch Dermatol Ges*. 2004;2(5):343-349.
15. Ogawa T, Low PA. Autonomic regulation of temperature and sweating. *Clinical autonomic disorders*. Philadelphia: Lippincott-Raven. 1997:83-96.
16. Low PA, Caskey PE, Tuck RR, Fealey RD, Dyck PJ. Quantitative sudomotor axon reflex test in normal and neuropathic subjects. *Ann Neurol*. 1983;14(5):573 -580.
17. Cabanac M. Temperature regulation. *Annu Rev Physiol*. 1975;37:415-439.
18. Hensel H. Thermoreception and temperature regulation. *Monogr Physiol Soc*. 1981;38:1 - 321.
19. Ogawa T. Thermal influence on palmar sweating and mental influence on generalized sweating in man. *Jpn J Physiol*. 1975;25(4):525-536.
20. Sugenoja J, Ogawa T, Jmai K, Ohnishi N, Natsume K. Cutaneous vasodilation responses synchronize with sweat expulsions. *Eur J of Appl Physiol Occup Physiol*. 1995;71 (1):33-40.
21. Asahina M, Suzuki A, Mori M, Kanesaka T, Hattori T. Emotional sweating response in a patient with bilateral amygdale damage. *Int J Psychophysiol*. 2003;47(1):87-93.
22. Wollina U, Abdel-Naser M, Ganceviciene R, Zouboulis C. (2007) Receptors of Eccrine, Apocrine, and Holocrine Skin Glands. *Dermatol Clin*. 2007;25(4):577-588.
23. Reisfeld R. Sympathectomy for hyperhidrosis: should we place the clamps at T2-T3 or T3-T4? *Clin Auton Res*. 2006;16(6):384-389.
24. Atkinson JL, Fealey RD. Sympathectomy instead of sympathectomy for palmar hyperhidrosis: minimizing postoperative compensatory hyperhidrosis. *Mayo Clin Proc*. 2003;78(2): 167-172.
25. Reisfeld R, Nguyen R, Pnini A. Endoscopic thoracic sympathectomy for hyperhidrosis: experience with both cauterization and clamping methods. *Surg Laparosc Endosc Percutan Tech*. 2002;12(4):255-267.
26. Miller DL, Bryant AS, Force SD, Miller JI Jr. Effect of sympathectomy level on the incidence of compensatory hyperhidrosis after sympathectomy for palmar hyperhidrosis. *J Thorac Cardiovasc Surg*. 2009;138(3):581-5.
27. Yano M, Kiriyaama M, Fukai I, Sasaki H, Kobayashi Y, Mizuno K, Haneda H, Suzuki E, Endo K, Fujii Y. Endoscopic thoracic sympathectomy for palmar hyperhidrosis efficacy of T2 and T3 ganglion resection. *Surgery*. 2005;138(1):40-45.
28. Gabella, G. Structure of the autonomic nervous system. In *Peripheral Neuropathy*. 4e. Elsevier Inc USA. 2005 ;1:233-245.
29. DeCastro, F. Sympathetic ganglia: Normal and Pathological. In *Peripheral Neuropathy*. 4e. Elsevier Inc USA. 2005;1:233-245.
30. Moya J, Ramos R, Prat J, Morera R, Bemat R, Villalonga R, Ferrer G. Histopathological changes in sympathetic ganglia of patients treated surgically for palmar-axillary hyperhidrosis. A study of 55 biopsies. *Arch Bronconeumol*. 2003;39(3):115-117.
31. Rathinam S, Nanjaiah P, Sivalingam S, Rajesh PB. Excision of sympathetic ganglia and the rami communicantes with histological confirmation offers better early and late outcomes in Video assisted thoracoscopic sympathectomy. *J Cardiothorac Surg*. 2008;3:50.
32. Yilmaz EN, Dur AH, Cuesta MA, Rauwerda JA. Endoscopic versus transaxillary thoracic sympathectomy for primary axillary and palmar hyperhidrosis and/or facial blushing: 5-year-experience. *Eur J Cardiothorac Surg*. 1996;10(3):168-72.

# Electronic Wastelands: Decomposing Computers and Communities Around the World

Kiran A. Massey, BSc, MSc<sup>a</sup>, Jordan Eunson<sup>b</sup>

<sup>a</sup>Northern Medical Program 2013, Faculty of Medicine, University of British Columbia, Vancouver, BC

<sup>b</sup>Copius Communications

## WHAT IS ELECTRONIC WASTE?

In the 1980s, the dawn of the computer revolution was brewing. At the time, few were interested; but merely 25 years later, approximately 88% of Canadians own a personal computer.<sup>1</sup> Unfortunately, with the ever-growing plethora of new programs and hardware, there is also an increase of electronic waste (e-waste): the disposal of electronic equipment, including computers, television screens, and cellular phones. In their original state, these products, which consumers rely on daily, are harmless. However, when improperly discarded, these products release lethal toxins into atmosphere, water, and soil. It is estimated that 20 to 25 million tonnes of e-waste are created worldwide annually, producing high levels of toxins and exposing workers and nearby residents of e-waste recycling plants to extremely toxic health consequences.<sup>2</sup>

## WHO CREATES VERSUS WHO SUFFERS FROM THE WASTE?

Even though environmental toxins affect all citizens, the majority of e-waste is created in and collected by North American and European companies and processed in developing nations such as India, Malaysia, China, and Ghana.<sup>3</sup> These countries are experiencing increasing rates of local and illegally imported e-waste primarily due to lack of national regulation and/or lax law enforcement.<sup>3</sup> Normally, these laws would protect against the growth of this semi-formal or informal economy in industrializing countries.

As a result these impoverished populations have built a new industry around e-waste which they increasingly rely on for economic sustainability. Their dependence on e-waste for income propagates within the communities as home-based waste workshops which employ low-cost migrant workers. These in-house processing facilities, which include a dismantling shop, are typically in multi-level homes.<sup>4</sup> Workers often use old and simple tools without protection, such as goggles, masks, or gloves, to strip

wires, melt metals, and separate computer parts.<sup>5</sup> By improperly assembling cheap recycled computers for resale, and creating “at home” facilities, these communities have advanced but at a dangerous cost: their health.



**Figure 1.** Recycling computer components at Free Geek in Vancouver. *Photo Credit:* Jordan Eunson.

## Correspondence

Kiran A. Massey, kamassey@interchange.ubc.ca

## E-WASTE DIRECTLY AFFECTS HUMAN HEALTH

Populations encountering the toxins from electronic devices could suffer from several health effects.

There have been many studies conducted to confirm that these health risks are indeed a result of toxins from nearby e-waste facilities as well as to assess health consequences in these populations. Since the kidney secretes many of these compounds, nephrotoxicity is a major concern with certain metal toxins – even low levels of cadmium cause glucosuria, aminoaciduria, and low molecular weight proteinuria, leading to hypercalciuria and renal stones.<sup>7</sup>

In a study by Wong *et al.*,<sup>8</sup> mercury-discarded electronics were identified as the main contributor of rising mercury emission into the atmosphere in China. Mercury filtered by the glomerulus and reabsorbed in the proximal convoluted tubules causes both tubular and glomerular damage leading to nephrotic syndrome, either because of membranous nephropathy or minimal change disease.<sup>7</sup>

In 2007, Huo *et al.*<sup>4</sup> found much higher serum lead levels in 165 children in the small Chinese town of Guiyu when compared to 61 children from a nearby town that did not participate in e-waste recycling or dumping. Acute exposure to lead can cause direct proximal tubular injury, including glucosuria, aminoaciduria, and phosphate wasting, all of which are potentially caused by mitochondrial dysfunction.<sup>7</sup> Lead toxicity also can result in chronic nephrotoxicity due to decreased clearance of uric acid, decreased estimated glomerular filtration rate (eGFR), or proteinuria.<sup>7</sup> Further studies by Soderland *et al.*<sup>7</sup> showed that chronic metal exposure leads to many serious conditions such as disruptions on calcium-mediated cell signaling and effects on the renin-angiotensin-aldosterone system, both of which can lead to hypertension. Most metal compounds, including nickel, chromium, beryllium, cadmium, arsenic, and gallium, are also known carcinogens.<sup>9</sup> In particular, hexavalent chromium (Cr VI), commonly found in metals, causes cancer by eliciting DNA damage in otherwise healthy cells.<sup>5</sup>

Like chromium, many small and lipid soluble toxins have the ability to enter cells and cause DNA damage. Unfortunately, in the large e-waste city of Tianjin, China, Lui *et al.*<sup>10</sup> used single cell gel electrophoresis to demonstrate a significantly greater degree of DNA damage in women than in men. This will lead to problems in forthcoming generations as many of these toxins cross the placenta and cause adverse affects on the resulting newborn. For example, children born to mothers who ingested large quantities of local fish contaminated with polychlorinated biphenyls (PCBs) were found to exhibit deficits in childhood intellectual function.<sup>11</sup>

Even though PBDEs are banned in some parts of the world, Ma *et al.*<sup>12</sup> found high levels of PBDEs on workshop floors, in electronic shredder waste, and in the dust and soil near e-waste facilities in eastern China. PBDEs might play an important role on thyroid hormone homeostasis and liver metabolism. Marsh *et al.*<sup>13</sup> suggested that two hydroxylated PBDE congeners induce both phase I and II metabolic enzymes in the liver as well as bind to human thyroid hormone receptor- $\alpha 1$  (TR- $\alpha 1$ ) and TR- $\beta$ .

Incinerated waste releases toxins, such as furans, polycyclic

**Table 1.** Common e-waste toxins and human health consequences. Adapted from Martin and Griswold.<sup>6</sup>

Toxic Chemical	Electronic Source	Health Consequence
Aluminum	Sheathing of computer wires and circuit boards	Disfiguring rashes, respiration problems (i.e. sarcoidosis), severe pulmonary damage, kidney disease, bone fragility
Barium	Front panel of the CRT monitor to protect users from radiation	Vomiting, diarrhea, high blood pressure, arrhythmias, paralysis
Beryllium	Motherboards and connectors	Severe lung damage, skin rashes, ulcers
Cadmium	Batteries, SMD chip resistors, infrared detectors, semiconductors, older types of cathode ray tubes, and some plastics	Kidney damage, lung damage, fragile bones
Chromium	Corrosion protection of untreated and galvanized steel plates. Hardener for steel housing	Asthmatic bronchitis, ulcers, liver damage, kidney failure, circulatory and nerve problems
Dioxin, or polychlorinated dibenzodioxins (PCDD)	Plastic casings. Released when electronics are incinerated or thrown in a landfill	Impairs immune system, developing nervous system, endocrine system and reproductive system
Lead	Found in liquid crystal display (LCD) screens in TV and Computer monitors. Soldering on the circuit boards	Acute exposure can cause vomiting, diarrhea, convulsions, coma, or death
Mercury	Light bulbs in flat panel displays, LCD screens, switches, & printed wiring boards all contain mercury	Ingestion or inhalation can cause central nervous system and kidney damage as well as tremors and memory lapses
Polybrominated diphenyl ethers (PBDEs)	Used as flame retardants plastic casings and components (print circuit boards). Released when electronics are incinerated	Disrupt hormones, (reduce levels of the hormone thyroxin which potentially harms the developing fetus in pregnant women), erythema, dryness, rash, hyperkeratosis, hyperpigmentation, some hepatic involvement, and elevated plasma triglycerides

aromatic hydrocarbons (PAHs), hydrogen chloride, and dioxin (otherwise known as polychlorinated dibenzodioxins (PCDD)), into our biosphere.<sup>14</sup> These chemicals are very dangerous because they are very stable, highly lipophilic, poorly metabolized, and very resistant to environmental degradation.<sup>11</sup> Chan *et al.*<sup>15</sup> found that the estimated daily intake of PCDD from an e-waste processing site in Taizhou, China ranked among the highest in the world. The World Health Organization classified dioxins as

a carcinogen in 1997.<sup>16</sup> Dioxins have also had adverse effects on laboratory animals, including wasting syndrome, thymic atrophy, epidermal changes, hepatotoxicity, immunotoxicity, and teratogenic effects on reproduction and development.<sup>11</sup>

## TECHNOLOGICAL RESPONSIBILITY

With technological growth, there has been a desire for the newest products. As 'new' models for old hardware are created, consumers upgrade. Likewise, the incompatibility of new software with previous versions or competitors leaves consumers eager to buy a newer and faster version of products they may already own and use. Unfortunately with these upgrades, new electronic devices are being created as single whole units without removable and replaceable parts such as batteries or screens. This discourages the modularized system of the past, which allowed replacement of individual parts to prolong the device's life, a process not unlike an organ transplant. More and more, however, an entire device is replaced instead of only its dead battery. This leads to high turnover of products, and the piles of e-waste continue to grow.

## POLITICAL RESPONSIBILITY

With the buildup of e-waste, it is crucial that we have safe and reliable disposal services. The "Basel Action Network" (BAN) is a global non-governmental organization which includes members from North America, the European Union, and developing nations. BAN is dedicated to forging the way for toxin-free methods of disposal as well as outlawing the hazards of toxic e-waste dumping.<sup>17</sup> Nationally, recycling groups require proper certifications for e-waste management. Canada, as part of the Basel Convention, has adopted the recycling certification regime, known as "e-Stewardship" to ensure the highest standards of environmental and social responsibility are used for e-waste recycling.<sup>18</sup> Locally, there are a number of Canadian organizations that have received such certification.<sup>19</sup>

## CONSUMER RESPONSIBILITY

E-waste is not unlike other forms of environmental hazards. Much like other environmental initiatives, such as reducing carbon footprints by choosing fuel-efficient or hybrid vehicles, the choices consumers make regarding e-waste have the potential to reduce its impact on developing countries. To protect victims of e-waste via disposability policies, consumer and disposers, particularly in developed countries, should focus on minimizing the amount of e-waste created. Consumers should look to purchase durable hardware with replaceable parts as this lowers the amount of e-waste created. Consumers should also challenge technology companies to create more sustainable products. For disposers of electronic goods, including computers, cell phones, down to AA batteries, verification of recycler integrity is critical. Thorough awareness and understanding of e-waste and its hazardous health effects requires only very small changes in our daily lives but could result in saving many children, families, and communities around the world from the dangers of e-waste. 



**Much like other environmental initiatives... the choices consumers make regarding e-waste have the potential to reduce its impact on developing countries.**

## REFERENCES

1. Union IT. Computer ownership. Pocket World in Figures [serial on the Internet]. 2008 [cited 2009 October 17]; Available from: [http://www.economist.com/research/articlesBySubject/displayStory.cfm?story\\_id=12758865&subjectID=348909&fsrc=nwl](http://www.economist.com/research/articlesBySubject/displayStory.cfm?story_id=12758865&subjectID=348909&fsrc=nwl).
2. Robinson BH. E-waste: an assessment of global production and environmental impacts. *Sci Total Environ.* 2009;408(2):183-91.
3. Widmer RO-KH, Sinha-Khetriwalk D., Schnellmann M., Boni H. Global perspectives on e-waste. *Environmental Impact Assessment Review.* 2005;25:436-58.
4. Huo X, Peng L, Xu X, Zheng L, Qiu B, Qi Z, *et al.* Elevated blood lead levels of children in Guiyu, an electronic waste recycling town in China. *Environ Health Perspect.* 2007;115(7):1113-7.
5. Li Y, Xu X, Liu J, Wu K, Gu C, Shao G, *et al.* The hazard of chromium exposure to neonates in Guiyu of China. *Sci Total Environ.* 2008;403(1-3):99-104.
6. Martin S. GW. Human Health Effects of Heavy Metals. Manhattan: Center for Hazardous Substance Research 2009 Contract No.: 15.
7. Soderland P, Lovekar S, Weiner DE, Brooks DR, Kaufman JS. Chronic kidney disease associated with environmental toxins and exposures. *Adv Chronic Kidney Dis.* 2010;17(3):254-64.
8. Wong CS, Duzgoren-Aydin NS, Aydin A, Wong MH. Sources and trends of environmental mercury emissions in Asia. *Sci Total Environ.* 2006;368(2-3):649-62.
9. Report on Carcinogens (RoC): Public Health Service. 2009.
10. Liu Q, Cao J, Li KQ, Miao XH, Li G, Fan FY, *et al.* Chromosomal aberrations and DNA damage in human populations exposed to the processing of electronics waste. *Environ Sci Pollut Res Int.* 2009;16(3):329-38.
11. Teitelbaum DT. Basic & Clinical Pharmacology: The McGraw-Hill Companies. Available from: <http://www.accessmedicine.com/content.aspx?aID=4522750>.
12. Ma J, Addink R, Yun SH, Cheng JP, Wang WH, Kannan K. Polybrominated Dibenzo-p-dioxins/Dibenzofurans and Polybrominated Diphenyl Ethers in Soil, Vegetation, Workshop-Floor Dust, and Electronic Shredder Residue from an Electronic Waste Recycling Facility and in Soils from a Chemical Industrial Complex in Eastern China. *Environmental Science & Technology.* 2009;43(19):7350-6.
13. Marsh AB, L.G. Bladh, M. Gillner and E. Jakobsson,. Synthesis of p-hydroxybromodiphenyl ethers and binding to the thyroid receptor. *Organohalogen Compd.* 1998;37:305-8.
14. Robinson BH. E-waste: An assessment of global production and environmental impacts. *Sci Total Environ.* 2009; 408(2):183-91
15. Chan JK, Xing GH, Xu Y, Liang Y, Chen LX, Wu SC, *et al.* Body loadings and health risk assessment of polychlorinated dibenzo-p-dioxins and dibenzofurans at an intensive electronic waste recycling site in China. *Environ Sci Technol.* 2007;41(22):7668-74.
16. World Health Organization. Dioxins and their effects on human health: Fact Sheet No.225. The Organization; 2007 [updated November 2007]; Available from: <http://www.who.int/mediacentre/factsheets/fs225/en/print.html>.
17. Basel Action Network. About the Basel Action Network. Seattle(WA): The Network; 2008 [cited 2009 October 19]; Available from: [http://ban.org/main/about\\_BAN.html](http://ban.org/main/about_BAN.html).
18. Basel Action Network. e-Stewards. The Network; 2010 [cited 2009 October 19]; Available from: <http://e-stewards.org/about>.
19. Free Geek qualifies as first Canadian non-profit to be recognized in ethical recycling program. Vancouver, BC: Free Geek Vancouver; 2009 [cited 2009 October 18]; Available from: <http://freegeekvancouver.org/fr/esteward>.

# A Tale of Two Tiers: Inequality in South Africa's Health Care System

Andrea Human, BSc<sup>a</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2011, Faculty of Medicine, University of British Columbia, Vancouver, BC

As a medical student and a native South African, a recent trip “home” sparked my interest in the local health care system. I discovered a two-tiered system that exposes the class inequality that continues to linger after the demise of the Apartheid regime. This vast disparity is severely impeding accessibility and quality of care in South Africa's medical system.

Universal health care is the basis of South Africa's public sector. The public branch provides free basic health care for every citizen who cannot afford medical aid (health insurance) or does not receive medical aid through employment.<sup>1</sup> Government employees and government-related groups are also served by the public system. This translates into a staggering 80% (about 35 million people) of the population.<sup>1</sup> Public health care is primarily accessed in clinics within townships and at public hospitals.<sup>1</sup> Again, quality of care varies with location. Public teaching hospitals in the major cities offer good service but struggle with the overwhelming demand.<sup>1</sup> Rural hospitals contend with poor building conditions, broken equipment and even scarcer resources, which severely impede service.<sup>1</sup>

The private health care system is a different story. It serves the remaining 20% (seven million people) of the population, but it utilizes the majority of the resources and technology available within the country.<sup>1</sup> Private sector hospitals are tertiary care centers that offer specialist services.<sup>1</sup> This is in contrast to the public hospitals and clinics, which are limited to acute and primary care services. Furthermore, physicians and other medical staff are drawn to the private sector by better facilities and better wages.<sup>1</sup> This leaves the public sector with over-worked and under-compensated health care professionals.

These factors combine to create a public health care system that does not – and cannot – provide the same quality of care as the private health care system. Complicating this problem is the relatively limited access to health information in poor and remote

areas of the country. Thus, many people in these areas may rely on traditional healers. Many people with mental health issues may also seek these alternative services as opposed to modern methods.<sup>2</sup> Furthermore, traditional concepts can be incorporated into the training of modern health workers, providing care to patients with psychiatric issues. Currently, evidence suggests that traditional concepts regarding mental health need to be incorporated into the training of modern health workers providing care to patients with psychiatric issues.<sup>2</sup> Increased collaboration between traditional and modern medicine could greatly benefit a large portion of the population. Recognizing this opportunity, the Department of Health in South Africa has trained some traditional healers to provide primary health care.<sup>1</sup> This represents an important alliance – one that will hopefully improve health care accessibility in areas with dire need.

Reducing the great disparity between the quality of care in the public and private sectors is one of South Africa's greatest challenges. Encouragingly, it seems the

government is starting to make equal-access health services a greater priority. Hopefully, South Africa will continue to develop and expand upon their current programs, in order to realize the ideals of universal health care. Needless to say, this beautiful country has overcome incredible obstacles in the past in the name of freedom and equality. It is my sincerest belief that they are up for this challenge as well. ♡

“  
Reducing the great disparity  
between the quality of care in  
the public and private sectors is one of  
South Africa's greatest challenges.”

## REFERENCES

1. Kautzky K, Tollman SM. A perspective on primary health care in South Africa. In: Barron P, Roma-Reardon J, editors. South african health review 2008. Durban: Health Systems Trust; 2008. URL:[http://www.hst.org.za/uploads/files/chap2\\_08.pdf](http://www.hst.org.za/uploads/files/chap2_08.pdf)
2. Lutgei E, Friedmani I, Mbathai T. A review of health research in South Africa from 1994 to 2007. In: Barron P, Roma-Reardon J, editors. South african health review 2008. Durban: Health Systems Trust; 2008. URL: [http://www.hst.org.za/uploads/files/chap14\\_08.pdf](http://www.hst.org.za/uploads/files/chap14_08.pdf)

## Correspondence

Andrea Human, [andrehuman1@gmail.com](mailto:andrehuman1@gmail.com)

# Vancouver Home to Canada's First Multidisciplinary Vulvodynia Program

Ranita H. Manocha, BA<sup>a,b</sup>

<sup>a</sup>UBCMJ Staff Writer

<sup>b</sup>Vancouver Fraser Medical Program 2012, Faculty of Medicine, University of British Columbia, Vancouver, BC

Complex pain. Sexual dysfunction. Chronic illness. Physicians often shudder when they think of managing these conditions. In most cases, we rely on our health care colleagues to help us to that end. Vulvodynia, a chronic vulvar discomfort not accounted for by infectious, dermatologic, or neoplastic etiology, lies at the intersection of chronic pain and sexual dysfunction. Thus, the condition lends itself well to collaborative approaches.

Vulvodynia afflicts 16% of American women.<sup>1</sup> It may interfere with walking, wearing clothes, and sexual intercourse, immensely impacting quality of life. Therefore, treatment requires more than medical interventions. After managing her vulvodynia patients through group seminars and referrals to community physiotherapists and psychologists for several years, Vancouver gynaecologist Dr. Sydney Thomson decided a more effective approach was necessary, and Canada's first Multidisciplinary Vulvodynia Program (MVP) was born.

Under Thomson's direction, the MVP opened its doors at Vancouver General Hospital in October 2008. Community gynaecologists and family doctors refer women to the centre for four months of therapy; treatment includes education, medical pain management, pelvic floor physiotherapy, sexual therapy, and group cognitive-behavioural therapy. According to Thomson, MVP researchers follow patients to examine the efficacy of various treatment methods so that future patients can learn "how to implement the change and where."

Thomson believes one of the greatest patient benefits of the MVP is education. "After learning more about [vulvodynia]," she says, "patients feel more equipped" to deal with their situation. The centralized care model also allows different treatments to enhance each other. For example, many women with vulvodynia experience dyspareunia. This often decreases the woman's sexual desire and responses, which in turn increases tension in her pelvic floor muscles, heightening her vulvar pain and worsening her sexual states. At the MVP, while exploring alternative methods of increasing pleasure during intercourse, patients also work on relaxing their pelvic muscles. Both interventions minimize the psychological impact of vulvodynia.

The MVP also allows staff to follow a patient's care closely and learn from other staff with different expertise. Thomson feels that "being there in the physiotherapy session and learning what [the physiotherapist is] doing and what they deem is important and what's not so helpful just adds to [her] ability to care for [her] patients." In addition, Thomson finds that collaboration creates an "energizing" working environment.

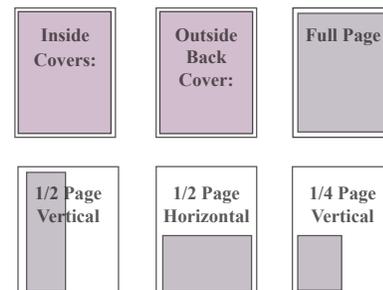
Working with others could pose challenges, however; Thomson cited interpersonal differences and inflexibility as two possible difficulties. She added that being "passionate and engaged and willing to adapt" would help individuals working in interdisciplinary settings. In addition, Thomson recommends that physicians engage with other health care providers and learn more about their roles and resources. She emphasizes that doing so will "ultimately save you time and will add to the quality of what you are giving to your patients." In this way, maybe physicians will stop shuddering and instead, hold out steadier hands to help patients with "complex" health issues better navigate through the health care system.

## REFERENCES

1. Harlow BL, Stewart EG. A population-based assessment of chronic unexplained vulvar pain: have we underestimated the prevalence of vulvodynia? *J Am Med Womens Assoc.* 2003 Spring;58:82-88.



The UBCMJ provides many options for your advertising needs



Please enquire about our Product Advertisement Rate Card at [www.ubcmj.com](http://www.ubcmj.com) or [advertising@ubcmj.com](mailto:advertising@ubcmj.com)

# Dr. S. Larry Goldenberg Receives the Order of Canada

Simon Jones, BSc, BPHE<sup>a,b</sup>

<sup>a</sup>UBCMJ Staff Writer

<sup>b</sup>Vancouver Fraser Medical Program 2011, Faculty of Medicine, University of British Columbia, Vancouver, BC

**D**r. S. Larry Goldenberg, professor and head of The Department of Urologic Sciences at the University of British Columbia and Founding Director of the Vancouver Prostate Centre at Vancouver General Hospital, was born and raised in Toronto and was an avid NHL fan. Although an inability to skate backwards kept him from playing ice hockey, Dr. Goldenberg recently found himself in the same line-up with former NHL great Mario Lemieux as they were appointed members to the Order of Canada.

In December of 2009, Dr. Goldenberg, Mario Lemieux, and 55 other Canadians were appointed to the Order of Canada, one of Canada's highest civilian honours, which recognizes a lifetime of outstanding achievement, dedication to community, and service to the nation. Dr. Goldenberg was honoured "for his contributions to prostate cancer research and treatment, as well as for promoting public awareness of the disease."

One of Dr. Goldenberg's greatest contributions to prostate cancer is the early promotion of alternative therapies for both benign and malignant disease based on scientific evaluations. This includes the clinical development of low dose antiandrogen/diethyl (DES) protocol for therapy of advanced prostate cancer, co-development of clinical protocols for neo-adjuvant hormonal therapy prior to radical prostatectomy, and testing the efficacy of intermittent androgen suppression (IAS) in men with advanced prostate cancer. Secondly, Dr. Goldenberg is recognized for the promotion and funding of cutting edge science and clinical care in British Columbia (BC). In his role, he has raised over \$100 million from government and philanthropic sources for prostate health; co-founded and developed the Vancouver Prostate Centre and the Canadian Urologic Oncology Group, both global leaders in clinical trials research for prostate cancer; and introduced the daVinci® Robotic surgical system to Vancouver General Hospital, which has revolutionized the surgical management of prostate cancer in BC.

As Dr. Goldenberg sets his sights on the future, he will forever remember his appointment to the Order of Canada as being "a most humbling experience," but he knows that his job is not quite finished. With prostate cancer research accelerating into the 21st century, Dr. Goldenberg and his team of researchers have an ultimate goal. They are "hoping to take a disease that

can be deadly, turn it into a chronic illness, hopefully cure it and ultimately prevent it." For all the men who will be affected by prostate cancer, let's hope that he is successful in reaching his goal. 

## UBC Goes Southern

Jay Joseph, MD, PhD<sup>a,b</sup>

<sup>a</sup>UBCMJ Staff Writer

<sup>b</sup>Vancouver Fraser Medical Program 2010, Faculty of Medicine, University of British Columbia, Vancouver, BC

**U**BC's MD undergraduate program is expanding with the addition of a new site. The first cohort of 32 UBC medical students based at the Southern Medical Program (SMP) site in B.C.'s beautiful Interior will begin studies in the fall of 2011.

Serving as the home base for first and second year students will be the Health Sciences Centre, a 4,266-square-metre building on the UBC Okanagan campus that houses video-conference equipped lecture halls and a gross anatomy laboratory.

The Clinical Academic Campus, a newly-built two-storey, 3,200-square-metre building on the Kelowna General Hospital campus (KGH) will serve clerkship students, residents, and faculty. It has a library, 11 clinical skills rooms, a 180 seat lecture theatre, administrative offices, and three video conference rooms that will be used for Academic Half-Days. Plans are also underway for the new six-storey Centennial Tower to be built on the KGH campus, which will house call-rooms for clerkship students and residents.

The Interior Health Authority has also purchased homes to provide students and residents completing rotations in the Interior with cost-effective temporary accommodation.

Like the Northern and Island Medical Programs, students will spend their first four months in Vancouver. Students will then move to the Interior for the remainder of the first two years of

the MD undergraduate program based at the new Health Sciences Centre where lectures will be video-conferenced from, and to, other sites. During Year 3 Clerkship, plans are for 24 students, based at Kelowna General Hospital and/or Royal Inland Hospital, to follow a traditional clerkship model of consecutive rotations. The remaining eight students will follow an integrated clerkship model at regional centres including the Royal Inland Hospital in Kamloops, the Vernon Jubilee Hospital, Penticton Regional Hospital, Kootenay Boundary, and East Kootenay Regional Hospitals.

The new Regional Associate Dean for the Southern Medical Program, Dr. Allan Jones, along with Drs. Connie Hull, Gerhard Schumacher, and Cheryl Holmes have been actively recruiting

clinical faculty with success. Dr. Holmes, Site Education Leader for the SMP, says she has been “pleasantly surprised by the [supportive] response of physicians” in Kelowna and in smaller communities in the Interior to the expansion. Clerkship rotations for psychiatry, obstetrics/gynecology, surgery, and anesthesiology have already been piloted with an emergency medicine rotation scheduled to be piloted in May 2010 and an ophthalmology rotation pilot in June 2010. Over 52 different electives have been developed for Year 4 Clerkship students of the new SMP.

Community awareness initiatives have not yet begun in earnest, but it is anticipated that community response will be positive given the appreciation for existing medical education programs within the B.C. Interior. 



Photo credit: UBC Faculty of Medicine



Photo credit: UBC Faculty of Medicine

**BRITISH  
COLUMBIA  
MEDICAL  
ASSOCIATION**



## Healthy Patients, Happy Doctors

The BCMA provides clinical, financial and insurance support to all medical student members as you continue on your journey and fulfill your career aspirations.

[www.bcma.org](http://www.bcma.org)

# Full of Love, and Hope and the Colour Red, Your Girl, Eva

Simon Jones, BSc, BPHE<sup>a,b</sup>

<sup>a</sup>UBCMJ Staff Writer

<sup>b</sup>Vancouver Fraser Medical Program 2011, Faculty of Medicine, University of British Columbia, Vancouver, BC

Eva Dien Brine Markvoort was born with cystic fibrosis, the most common fatal genetic disease in Canada. Eva, along with over 3,000 other children and young adults across Canada, suffered through the disabling symptoms of a disease that affects multiple organ systems in the body but has its most devastating effects on the lungs.<sup>1</sup> Cystic fibrosis clogs the lungs with mucous making each breath a struggle to survive. On March 27, 2010, Eva passed away from complications of this disease, just days shy of her 27<sup>th</sup> birthday.

In her life, Eva was an icon of strength as she publicly documented her fight against the fate of an incurable genetic disease. In her death, she leaves behind a legacy of a woman who knew the significance of love and the importance of organ donation.

Eva grew up in New Westminister, British Columbia as a girl with a magnetic personality and dramatic flair that drew her to the performing arts.<sup>2</sup> Beautiful and vivacious, Eva never veered away from playing a leading role. Little did she know that her biggest role would come from revealing her personal account of life in a battle with cystic fibrosis. Eva's voyage into the spotlight began four years ago as she started a private blog intending to keep in touch with others suffering from cystic fibrosis. She named her blog *65 Red Roses*, which is a malapropism for children trying to pronounce cystic fibrosis, with the addition of her favourite colour red.<sup>2</sup> Soon Eva opened her blog to the public and began chronicling the intimate details about her struggles living with cystic fibrosis, often in the form of poetry, stories, or pictures. "*I'm drowning in the medications,*" Eva wrote in her last post, highlighting her willingness to share and engage with her captive audience. "*I can't breathe, every hour, once an hour, I can't breathe. Something has to change.*" Eva's blog would eventually receive over one million views, expose people around the world to a woman living in the face of death, and show that an undying hope can be sustained by surrounding yourself with, what she referred to as, "*Love, Love, Love.*"

Eva's fearless story would ultimately be the subject of an award-winning documentary that would be seen in Canada, the

United States, and as far away as Poland.<sup>3</sup> Named *65\_Redroses* after her blog, this would not just be a story about a sick girl but a journey into the unlikely friendships that Eva developed as she awaited a double lung transplant. The film would end with Eva successfully receiving new lungs and a new start on life, but it was through her journey that Eva was able to voice a greater message about the importance of organ donation. Eva's powerful message had purposeful impact as organ donation in Canada tripled after the documentary was aired nationally.

Two years after receiving her new lungs, Eva was diagnosed with chronic organ rejection. Surrounded by friends, family, and the thousands of cards she had received from her fans around the world, Eva would take her last breath at Vancouver General Hospital while awaiting a second double lung transplant. Eva will be remembered as a daughter, sister, friend, fighter, activist, University of Victoria graduate, Queen's Jubilee Medal winner, and a Canadian Cystic Fibrosis Foundation Doug Summerhayes Award winner.<sup>2</sup> Eva once wrote, "*A mark on the world. A difference. Some proof that I mattered. That when my body left this world*

*my soul had made its imprint.*"<sup>2</sup> In telling her story of love and hope in a time of struggle, and by raising awareness about the importance of organ donation, Eva can be rest assured that she has forever left her imprint.

Eva's blog can be found at [65redroses.livejournal.com](http://65redroses.livejournal.com) and the *65\_Redroses* documentary at [www.65redroses.com](http://www.65redroses.com).<sup>3</sup>



In this photo: Eva Dien Brine Markvoort

## REFERENCES

1. Canadian Cystic Fibrosis Patient Data Registry Report, 2007. Canadian Cystic Fibrosis Foundation. Available from: [http://www.cysticfibrosis.ca/assets/files/pdf/CPDR\\_ReportE.pdf](http://www.cysticfibrosis.ca/assets/files/pdf/CPDR_ReportE.pdf).
2. Eva Markvoort. *65 Red Roses: Thoughts on Living with Cystic Fibrosis*. Vancouver, BC: Livejournal.com; [updated 2010 June 13; cited 2010 July 19]. Available from: <http://www.65redroses.livejournal.com>.
3. *65\_redroses*. *65\_redroses reviews and awards page* [homepage on the internet]. Vancouver, BC: Good Company Communications; 2006-2010 [updated 2010 July 13; Cited 2010 July 26]. Available from: [http://www.65redroses.com/?page\\_id=17](http://www.65redroses.com/?page_id=17).

# UBCMJ Congratulates Mr. Michael Suen, Winner of the Pollock Clinics Distinguished Writing Award for Issue 1.2: Global Health

UBCMJ Staff



*In this photo:* Mr. Michael Suen

The UBC Medical Journal is proud to recognize the first winner of the Pollock Clinics Distinguished Writing Award, Mr. Michael Suen, from UBC Medicine's class of 2011 for his article "Sorafenib, A New Treatment for Advanced Hepatocellular Carcinoma: The Preliminary British Columbia Experience."

Multiple nominations were received from UBCMJ Section Editors. We would like to thank our judges for their generous help: Dr. David Hardwick (Vancouver Fraser Medical Program), Dr. Oscar Casiro (Island Medical Program), and Dr. David Snadden (Northern Medical Program).

Mr. Suen has been recognized before for his excellent writing. In 2007, he was awarded the Physiology Prize for the best graduating thesis in his Bachelor of Sciences degree with Honours from UBC.

In the Spiti Valley of India, he gained further health care research experience. As a Global Health Initiative project in the summer of 2009, he was part of a team that prepared projects aimed at improving the health of students at a boarding school. Mr. Suen's research focused on treating anemia using a sustainable, community-directed approach. His findings have been presented with excellent reception at multiple research forums, including

the Yale University Unite for Sight conference, the MUS-UBCMJ Research Forum, and the Canadian National Medical Student Research Symposium.

His tip for other students interested in research? "Find a project that you actually enjoy learning about and researching. Otherwise, when you're collecting data at 3am you're going to hate yourself. And some of my best data was obtained from 3 to 4am!"

The UBCMJ is pleased to award the Pollock Clinics Distinguished Writing Award for each issue. Winners are recognized with a \$250 prize courtesy of the Pollock Clinics. 



## The Society of General Practitioners of BC

- The SGP represents the Section of General Practice in the BCMA and advocates strongly for the pivotal role of the General and Family Physician in the delivery of Primary Care in BC.
- The SGP advocates for improved funding through the GP Subsidiary Negotiations Committee.
- Membership in the SGP provides access to our website where members can find billing and practice management tools.  
[www.sgp.bc.ca](http://www.sgp.bc.ca)
- MEMBERSHIP IS FREE FOR ALL MEDICAL STUDENTS AND FAMILY PRACTICE RESIDENTS.

**For more information contact:**  
**(604) 638-2943 Fax (604) 736-6160**

# An Innovative Model for Interprofessional Education and Practice: A Student-Run Interprofessional Rehabilitation Medicine Clinic

Sepehr Khorasani, BSc<sup>a</sup>, Tonia Berg, BSc<sup>a</sup>, Mohammadali Khorasani, BAppSc<sup>a</sup>, Sabrina Kolker, BA, MA<sup>a</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2012, Faculty of Medicine, University of British Columbia, Vancouver, BC

## ABSTRACT

Interprofessional patient-centred care improves health outcomes and may lower cost of care. Despite this, students graduating from health care programs often do not receive adequate training to integrate into an interprofessional team. This commentary proposes that interprofessional student-run clinics should be integrated into formal health and human service curricula to serve as an innovative model to implement interprofessional education. A student-run rehabilitation medicine clinic can offer needed services to underserved communities, thereby improving their access to care for patients with multiple and complex chronic diseases. Additionally, it provides a unique and important educational experience where students can learn about cost efficiency, patient advocacy, and collaboration while developing their skills in the management, monitoring, and delivery of quality care.

**KEYWORDS:** *interprofessional, student-run clinic, collaboration, undergraduate healthcare education, patient care*

## INTRODUCTION

According to the 2005 CanMEDS Physician Competency Framework, in the modern multiprofessional environment where the complexity and delivery of patient-centred care is rapidly increasing, it is imperative for physicians to be able to collaborate effectively in an interprofessional setting.<sup>1,2</sup> The inclusion of such interprofessional collaboration in the delivery of healthcare is not surprising given not only the need for a more sustainable and innovative use of human health resources but also an emergent aging population characterized by a marked prevalence of chronic illnesses that necessitates an effective team of diverse health and social care professionals to coordinate their care.<sup>3</sup> Research demonstrates that interprofessional teams may not only lower costs, decrease patients' length of stay, and reduce medical errors, but that they also provide higher patient satisfaction and ultimately enhance patient care outcomes.<sup>2,4-9</sup> Despite this, health care students typically graduate from programs which train collaboration in isolation from students of other disciplines.<sup>10</sup> Furthermore, a 2005 Cochrane review suggested a deficiency in collaborative work among professionals and proposed interprofessional education initiatives as a potential solution.<sup>11</sup>

To further signify the importance of implementing ways of increasing interprofessional preparedness upon graduation, several international agencies such as the World

Health Organization (WHO), the Organization for Economic Cooperation and Development (OECD), the World Federation of Medical Education (WFME), and the Institute of Medicine (IOM) have emphasized the significance of interprofessional education (IPE) and practice.<sup>6,12</sup> There is an emerging number of proposed methods to implement and evaluate IPE such as interprofessional team building workshops,<sup>8</sup> interprofessional education days, interprofessional simulation activities,<sup>7</sup> as well as small and large group panel presentations and interactive exercises.<sup>10</sup> In this commentary, we propose the model of a student-run interprofessional rehabilitation medicine clinic as another method for teaching collaborative competencies as one of the IPE opportunities for health and human service students.

### IPE Definition

The following is a definition of IPE described in 2002 by the Centre for the Advancement and Interprofessional Education and later expanded by the American Association of Colleges of Pharmacy Interprofessional Education Task Force:<sup>13, 14</sup>

“Interprofessional education involves educators and learners from two or more health professions and their foundational disciplines who jointly create and foster a collaborative learning environment. The goal of these efforts is to develop knowledge, skills, and attitudes that result in interprofessional team behaviours and competence. Ideally, interprofessional education is incorporated throughout the entire curriculum in a vertically and horizontally-integrated fashion.”

### Correspondence

Sepehr Khorasani, sepehr\_k@interchange.ubc.ca

## PROPOSED MODEL: A STUDENT-RUN INTERPROFESSIONAL REHABILITATION MEDICINE CLINIC

The model we propose involves collaborative assessment during a patient encounter, team discussion (including the patient), and an interprofessional plan of care (Figure 1). This initiative will take place in an out-patient primary care rehabilitation clinic which is located within a tertiary care hospital and is fully equipped with individual treatment stations, reception, and shared clerical spaces. The interprofessional team is composed of health care students and supervisors from the disciplines of medicine, physiotherapy, and occupational therapy. Together, they will work with individual patients over a span of three to five weeks depending on their individual treatment plans. The student-run clinic would serve patients with varied health conditions primarily from rehabilitation medicine, including those with neurological conditions (e.g. stroke and multiple sclerosis), orthopaedic (e.g. post-arthroplasty and discectomy), cardiovascular, and respiratory illnesses (e.g. chronic obstructive pulmonary disease), and those with concurrent endocrine conditions (e.g. diabetes) and physical deconditioning. Various aspects of patient care are performed under the direct supervision of the respective supervisor who, together with students, form a team that assumes responsibility of care for the patient. This model focuses on interprofessional interaction and planning and promotes explicit collaboration across professions in the context of a student-run clinic.

### IPE IN THE CONTEXT OF A CLINIC

The focus of the student-run clinic is two-fold: service and learning, which together can satisfy the development of an interprofessional curriculum while meeting the needs of the community.

#### Service

A commitment to social responsibility is recognized as an important motivation among educators and universities.<sup>15</sup> To achieve this, the clinic should be 1) located in a community setting and 2) focused on the needs of the community.<sup>16,17</sup> The clinic has a strong component of rehabilitation medicine where patients with complex social and medical conditions are being cared for and whose needs are not being adequately met elsewhere.

#### Learning

The second focus is modeled around meaningful learning objectives that are shared by all professions. This learning focus would allow students to develop and foster program-specific skills such as taking histories, presenting cases, as well as working with others to assess, provide treatment, and monitor individual patient plans. Together, these learning experiences satisfy the students' respective curricular requirements.<sup>18</sup> In addition, participation in a student-run clinic allows students to fulfill collaborative competencies that are shared and reinforced among allied health educational programs.<sup>19,20</sup> Namely, by employing a range of teaching and learning strategies through small group learning, the clinic provides an ideal opportunity for students to

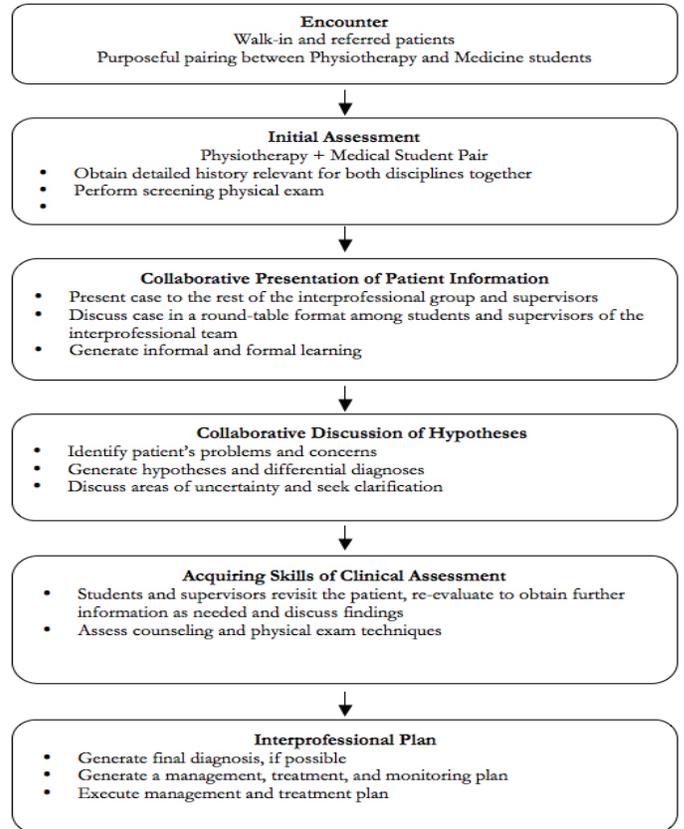


Figure 1. Proposed method for a student-run clinic IPE learning experience.

engage in a clinical setting mediated by respect, mutual trust, and an enhanced understanding of each other's profession.<sup>21</sup> It will also allow students to better recognize their own limitations while familiarizing them with the valuable resources offered by other health care professions to complement patient care while mitigating inaccurate attitudes and perceptions based on stereotypes and assumptions.<sup>1,22</sup>

### WHY STUDENT-RUN

There are many advantages to implement IPE in a student-run setting, both from the perspective of students and of the patient being served. A free student-run clinic can offer needed services to the community, improve access to care for underserved patient populations, and may appeal to patients in a way other providers do not.<sup>18</sup> Some of these appealing factors may include additional time with the patient and operating flexibility to serve patients whose needs are complex and multifactorial.<sup>18,23</sup> Conversely, one of the drawbacks of such a clinic would be the time consuming nature of a teaching clinic and an inexperienced collaborative learning setting. From the students' perspective, Hoffman *et al.* found that students were attracted to IPE experiences because of the possibility of enhancing patient care, advancing their careers, and learning more about diverse disease conditions.<sup>24</sup> In such a setting, students play an integral role in logistical planning and managing the clinic while learning the principles of cost-efficiency, resource allocation, patient advocacy, monitoring and delivery of care to the underserved.<sup>25</sup> Taken together, the service,

learning, and student-run components of this type of clinic can potentially provide a unique and important academic-community partnership currently not provided by didactic curricula.

## CHALLENGES

Traditionally, attitudinal differences among various faculties in regards to the need for IPE have been recognized as one of the barriers to initiation of IPE.<sup>26</sup> However, the health and human services program objectives share similar visions with respect to the importance of collaborative patient-centred education and its incorporation into their respective curricula.<sup>27</sup> The success of garnering support for starting an initiative such as this is primarily driven by the support and enthusiasm of students, dedicated faculty members, policy makers, and the local health authority.<sup>28</sup>

One of the potential obstacles in the implementation of this initiative is the identification of a cadre of well-trained clinical supervisors competent in rehabilitation medicine and interdisciplinary team education.<sup>29,30</sup> Additional anticipated barriers include providing a continuum of care by the same students over multiple visits for a patient as students rotate through shifts. Furthermore, finding sustainable sources of funding to attract and reimburse supervising instructors, providing medical equipment, and addressing administrative costs present additional challenges.

To address some of these concerns, we would like to propose that the student-run interprofessional clinic should be integrated into undergraduate medical curricula. In their work at the clinical education ward at the Karolinska Institute, Ponzer *et al.* and Hylin *et al.* found that introducing IPE in undergraduate education provided lasting positive learning outcomes that may promote future collaborative care.<sup>31,32</sup> However, in trying to move this objective forward, juggling high curricular demands, as well as scheduling conflicts across disciplines are further anticipated challenges as the various programs may schedule clinical experiences at different stages of their respective curricula.<sup>29</sup>

## EVALUATION

Looking forward, one of the most important aspects of the model includes the evaluative process, particularly measured outcomes with qualitative methods that appraise the effectiveness of the clinic in enabling collaboration.<sup>33</sup> The clinical supervisors should dedicate time for open discussion, evaluation, and adjustments of teaching methods. Jacobsen *et al.* also advocated for meetings daily, weekly, as well as on an ad hoc basis to allow for cooperation between tutors and the project manager.<sup>34</sup>

## THE FUTURE

We hope that the pilot student-run clinic, that includes students and supervisors from various healthcare programs, will serve to integrate interprofessional learning experiences in the clinical teaching setting. A long term objective for medical curricula is to expand the interprofessional team to incorporate other health care disciplines such as dietetics, pharmacy, and nursing in order to better serve the target population while fostering the ideals of interprofessional care. It is our hope that educational institutions

will embrace interprofessional education and collaborative learning through the formal incorporation of student-run interprofessional initiatives. This serves as a unique and important part of improving patient care as well as an opportunity to engage in innovative teaching and learning that meets the university's mission, goals, and strategic planning. 

## REFERENCES

1. Royal College of Physicians and Surgeons. The CanMEDS 2005 Physician Competency Framework. [updated 2010 May 13; cited 2010 Feb 2]. Available from: <http://rcpsc.medical.org/canmeds/CanMEDS2005/index.php>.
2. Baldwin DC, Jr. Some historical notes on interdisciplinary and interprofessional education and practice in health care in the USA. 1996. *J. Interprof. Care.* 2007 Oct;21 Suppl 1:23-37.
3. Health Professions Regulatory Advisory Council. Critical Links: Transforming and Supporting Patient Care. January 2009.
4. Cullen L, Fraser D, Symonds I. Strategies for interprofessional education: The interprofessional team objective structured clinical examination for midwifery and medical students. *Nurse Educ. Today.* 2003 Aug ;23(6):427-433.
5. Headrick LA, Wilcock PM, Batalden PB. Interprofessional working and continuing medical education. *BMJ.* 1998 Mar 7;316(7133):771-4.
6. Institute of Medicine. Institute of Medicine Committee on the Health Professions Education Summit. Health Professions Education: A Bridge to Quality. 2003.
7. Reeves S, Freeth D. The London training ward: An innovative interprofessional learning initiative. *J. Interprof. Care.* 2002 Feb ;16(1):41-52.
8. Wee B, Hillier R, Coles C, Mountford B, Sheldon F, Turner P. Palliative care: a suitable setting for undergraduate interprofessional education. *Palliat. Med.* 2001 Nov ;15(6):487-92.
9. Ellett JD, Campbell JA, Gonsalves WC. Patient satisfaction in a student-run free medical clinic. *Fam. Med.* 2010 Jan ;42(1):16-8.
10. Freeth D. Sustaining interprofessional collaboration. *J. Interprof. Care.* 2001 Feb ;15(1):37-46.
11. Reeves S, Zwarenstein M, Goldman J, Barr H, Freeth D, Koppel I, *et al.* The effectiveness of interprofessional education: Key findings from a new systematic review. *J. Interprof. Care.* 2010 May;24(3):230-41.
12. World Health Organization. The Atma Ater Declaration. Geneva. World Health Organization. 1978.
13. Centre for the Advancement of Interprofessional Education. Interprofessional education - A definition. 1997.
14. American Association of Colleges of Pharmacy Interprofessional Education Task Force. Final Report of 2006-2007 Council of Faculties.
15. Boelen C, Woollard B. Social accountability and accreditation: A new frontier for educational institutions. *Med. Educ.* 2009 Sep ;43(9):887-94.
16. Barr H. Interprofessional education: The fourth focus. *J. Interprof. Care.* 2007 Oct DAY;21 Suppl 2:40-50.
17. Oandasan I, Reeves S. Key elements for interprofessional education. Part 1: the learner, the educator and the learning context. *J. Interprof. Care.* 2005 May ;19 Suppl 1:21-38.
18. Simpson SA, Long JA. Medical student-run health clinics: Important contributors to patient care and medical education. *J. Gen. Intern. Med.* 2007 Mar ;22(3):352-6.
19. Barr H. Competent to collaborate: Towards a competency-based model for interprofessional education. *J. Interprof. Care.* 1998 Jan;12(2):181.
20. Verma S, Paterson M, Medves J. Core competencies for health care professionals: What medicine, nursing, occupational therapy, and physiotherapy share. *J. Allied Health.* 2006 Summer;35(2):109-15.
21. Barr H. Interprofessional Education: Today, yesterday and tomorrow. 2002.
22. Margalit R, Thompson S, Visovsky C, Geske J, Collier D, Birk T, *et al.* From professional silos to interprofessional education: Campus wide focus on quality of care. *Qual. Manag. Health Care.* 2009 Jul-Sep;18(3):165-73.
23. Moskowitz D, Glasco J, Johnson B, Wang G. Students in the community: An interprofessional student-run free clinic. *J. Interprof. Care.* 2006 Jun ;20(3):254-9.
24. Hoffman SJ, Rosenfield D, Nasmith L. What attracts students to interprofessional education and other health care reform initiatives? *J. Allied Health.* 2009 Fall;38(3):e75-8.
25. Meah YS, Smith EL, Thomas DC. Student-run health clinic: Novel arena to educate medical students on systems-based practice. *Mt. Sinai J. Med.* 2009 Aug ;76(4):344-56.
26. Gardner SF, Chamberlin GD, Heestand DE, Stowe CD. Interdisciplinary

- didactic instruction at academic health centers in the United States: Attitudes and barriers. *Adv. Health. Sci. Educ. Theory Pract.* 2002 Nov;7(3):179-90.
27. Accreditation of Interprofessional Health Education. Principles and practices for integrating interprofessional education into the accreditation standards for six health professions in Canada. 2009.
  28. Griner PF. Leadership strategies of medical school deans to promote quality and safety. *Jt. Comm. J. Qual. Patient Saf.* 2007 Feb DAY;33(2):63-72.
  29. Gilbert JHV, Camp II RD, Cole CD, Bruce C, Fielding DW, Stanton SJ. Preparing Students for Interprofessional Teamwork in Health Care. *J. Interprof Care.* 2000 Jan;14(3):223-35.
  30. Flaherty E, Hyer K, Kane R, Wilson N, Whitelaw N, Fulmer T. Using case studies to evaluate students' ability to develop a geriatric interdisciplinary care plan. *Gerontol. Geriatr. Educ.* 2003 Jan 1;24(2):63-74.
  31. Ponzer S, Hylin U, Kusoffsky A, Lauffs M, Lonka K, Mattiasson AC, *et al.* Interprofessional training in the context of clinical practice: Goals and students' perceptions on clinical education wards. *Med. Educ.* 2004 Jul ;38(7):727-36.
  32. Hylin U, Nyholm H, Mattiasson AC, Ponzer S. Interprofessional training in clinical practice on a training ward for healthcare students: A two-year follow-up. *J. Interprof Care.* 2007 Jun ;21(3):277-88.
  33. Zwarenstein M, Goldman J, Reeves S. Interprofessional collaboration: Effects of practice-based interventions on professional practice and healthcare outcomes. *Cochrane Database Syst. Rev.* 2009 Jul 8;(3)(3):CD000072.
  34. Jacobsen F, Fink AM, Marcussen V, Larsen K, Hansen TB. Interprofessional undergraduate clinical learning: Results from a three year project in a Danish interprofessional training unit. *J. Interprof Care.* 2009 Jan ;23(1):30-40.

# Medicare in BC: Choosing an Evidence-based Future

Rupinder Brar, BSc<sup>a</sup>, Matthew Cooper, BSc<sup>a</sup>, Spencer Cleave, BSc<sup>a</sup>, Persia Pourshahnazari, BSc<sup>a</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2012, Faculty of Medicine, University of British Columbia, Vancouver, BC

## ABSTRACT

Health care in Canada is a contentious topic that sparks much debate. Discussions on the future of Medicare pit public and profit-driven health care delivery models against each another, often with wait times at the forefront of the dispute. By examining the current legal challenges in British Columbia, analyzing the peer-reviewed evidence, and exploring various initiatives that decrease wait times without profit motives, we strive to illustrate the importance and feasibility of maintaining all five central pillars of the Canada Health Act: accessibility, universality, comprehensiveness, public administration, and portability.

**KEYWORDS:** *Medicare, health care, Canada, public sector, private sector*

Canada's health care climate is often portrayed in the media as confused and fraught with critical problems, pitting public and for-profit models against each other. The debate focuses around several key issues: the role of investor-owned, for-profit delivery and private insurance; the most appropriate wait times in a publicly funded health care system; the successes and failures of private financing and profit-driven delivery in health care in other countries; and the alternative nonprofit driven solutions. As medical students we are charged with critically appraising evidence to extract the most accurate information. So what does the evidence reveal? We will look at the court case of *Canadian Independent Medical Clinics Association v. Medical Services Commission of British Columbia* (CIMCA case) and examine peer-reviewed literature to gain an evidence-based perspective on how best to deliver and finance health care in Canada.

In January 2009, the CIMCA and a group of privately owned clinics and surgical facilities, including the for-profit Cambie Surgery Clinic and False Creek Surgical Centre in Vancouver, British Columbia, launched a claim against the B.C. provincial

government. They argued that four sections of the B.C. Medicare Protection Act violate the Canadian Charter of Rights and Freedoms by preventing patients from accessing the medical care of their choice and physicians from providing privately funded care for medically necessary services.<sup>1</sup> The Medical Services Commission launched a counterclaim, arguing that the privately owned clinics had engaged in the practice of "illegal extra billing," wherein the clinics bill the patients for medically necessary services exceeding the amount paid by the provincial medical service plan.<sup>2</sup> Section 20 of the Canada Health Act states that if a province allows any physician to charge a patient more than what is provided publicly for a medically necessary procedure, the federal government must intervene. Therefore, extra billing may place the province at risk of serious financial penalties.<sup>3</sup> CIMCA maintained that it was unconstitutional to disallow patients to seek privately funded health care in the face of increasing wait times; however, the provincial government believed that CIMCA "intended to cause economic loss to the province."<sup>3</sup>

At issue in the CIMCA case was a model of private health care integration called a parallel public-private system. In this system, patients could pay, either out-of-pocket or through privately held insurance, for faster access to treatments that are normally publicly funded. According to the Romanow report,

## Correspondence

Rupinder Brar, rupbrar@gmail.com

waiting for care is the primary reason Canadians say they would pay for private treatment.<sup>5</sup> Britain has experimented with this system with no success in reducing overall wait times: a 2004 report noted that in areas where there were high levels of private insurance coverage, there were longer-than-average wait lists.<sup>4</sup> In a 2005 Supreme Court case, *Chaoulli v. Quebec*, the Court decided, if wait times in the public system were excessive, prohibiting private medical insurance violated the Quebec Charter of Human Rights and Freedoms.<sup>6</sup> CIMCA argued that the allowance of long wait times is essentially a denial of timely access to medical care and requested that the B.C. Supreme Court use the *Chaoulli* case as precedent for their claim.<sup>3</sup>

To further discuss the CIMCA case we must critically examine the true length of wait times in Canada and whether the addition of private funding of medical care is a desirable solution. A common misconception is that many specialties routinely experience unacceptable wait times. In 2005, health ministers across Canada set safe and acceptable benchmark wait times based on clinical evidence.<sup>7</sup> The Canadian Institute for Health Information conducted a study indicating that the percentage of patients receiving treatment within wait time benchmarks was very high for most procedures (i.e. 95% for cancer radiation treatment), but for a small number of other procedures, particularly in orthopaedics, the percentage was lower (i.e. 71% for knee replacement).<sup>7</sup> The existence of excessive wait times for a small percentage of procedures has been used as representative of our entire system to argue for a commercialized solution.<sup>7</sup>

While wait times are not as significant as we are sometimes meant to believe, this is not to say that they not worth addressing. Patients must go through many steps in accessing health care, each contributing to wait times: from the family doctor's referral to a specialist, to appointments for diagnostic testing, and to the eventual treatment. Other variables, including missed appointments by the patients themselves, may cause additional waits. While many believe that the management of wait lists is efficient, some patients may wait years to see a specific surgeon when they could have seen another surgeon in much less time.<sup>7,8</sup>

In response to this issue, successful public options for reducing orthopaedic surgery wait times have been explored. The Alberta Hip and Knee Replacement Project, for example, was created to address the issue of orthopaedic wait times. It was a collaborative effort on the part of the government, local regional health boards, Alberta Bone and Joint Health Institute, and orthopaedic surgeons to create a single site for the assessment, diagnosis, and treatment of hip and knee injuries. An interdisciplinary team was formed to assess patients' need for surgery and eventual outcomes. These measures were found to greatly reduce the number of last-minute cancellations.<sup>8</sup> The team sought to standardize many aspects of patient care, including operating equipment, follow-up procedures, and evidence-based practices. This saved operating room setup time and cut costs by allowing bulk equipment ordering. Overall, this initiative reduced wait times from General Practitioner referral to first surgical consult by 80% and total wait times by 41%. Length of hospital stay also decreased by 30% due to increased continuity in post-operative care.<sup>8</sup>

Another example of a successful publicly funded initiative to reduce wait times is the Richmond Hip and Knee Pilot Project. A collaborative effort within the public health sector, this project organized two operating rooms with standardized equipment and procedures dedicated to hip and knee surgeries. The specialization of these rooms allowed for quick and effective operations, and surgeons were able to increase the number of joint replacements per day from six to eight. This initiative decreased median wait times from 20 months to five, and decreased the waitlist total by 27%. The average length of hospital stay was also reduced by 25%.<sup>8</sup>

A 2005 poll stated that 85% of Canadians still report being somewhat or very satisfied with our health care system; yet, reports in the press can make us feel as though our system is largely failing Canadians, and the only viable solution lies in the for-profit system.<sup>9</sup> As medical students, we are taught to treat patients based on evidence. We are also taught to advocate for our patients. It is crucial to remain aware of the potential for inequity that investor-owned, for-profit financing and delivery of medical care could create. In the face of successful nonprofit options, the evidence has yet to corroborate the need for increased commercialization of Canadian health care. The evidence does show that for-profit alternatives improve care only for a select few whereas not-for-profit solutions, if pursued with the same vigor, can offer similar improvements for all. If we ignore nonprofit options for the future of Medicare, we risk abandoning the principle of universal accessibility upon which it was founded – that healthcare should be distributed based on the burden of disease, not the privilege of wealth. 

## REFERENCES

1. Writ of summons, Canadian Independent Medical Clinics Association v. Medical Services Commission of British Columbia. [Document on Internet]. 2009 [cited 2010 Feb 23]; [18 p.]. Available from: <http://www.bchealthcoalition.ca/images/PDF/Privatization/cimca%20writ.pdf>.
2. Statement of defense and counterclaim, Canadian Independent Medical Clinics Association v. Medical Services Commission of British Columbia. [Document on Internet]. 2009 Feb 20 [cited 2010 Feb 23]; [22 p.]. Available from: <http://www.bchealthcoalition.ca/images/PDF/Privatization/bc%20gov/t%20statement%20of%20defense%20and%20counterclaim.pdf>.
3. Kondro W. Claim and counter claim, Canadian Independent Medical Clinics Association v. Medical Services Commission of British Columbia. CMAJ. 2009;180(10):1009.
4. Tuohy CH, Flood CM, Stabile M. How does private finance affect public health care systems? marshaling the evidence from OECD nations. J Health Polit Policy Law. 2004;29(3):359-96.
5. Romanow R. Building on values: the future of health care in Canada. Final report of the Commission on Further of Health Care in Canada. 2002.
6. Steinbrook R. Private health care in Canada. NEJM. 2006;354(16):1661-4.
7. Canadian Institute for Health Information. Health care in Canada 2009: a decade in review. [Online]. 2009 [cited 2010 Jan 25]; [120 p.]. Available from: [http://secure.cihi.ca/cihiweb/products/HCIC\\_2009\\_Web\\_e.pdf](http://secure.cihi.ca/cihiweb/products/HCIC_2009_Web_e.pdf).
8. Priest A, Rachlis M, Cohen M. Why wait? Public solutions to cure surgical waitlists. BC government's conversation on health. [Online]. 2007 [cited 2010 Jan 15]; [40 p.]. Available from: [http://www.health.gov.bc.ca/library/publications/year/2007/conversation\\_on\\_health/media/why\\_wait\\_surgical\\_waitlists.pdf](http://www.health.gov.bc.ca/library/publications/year/2007/conversation_on_health/media/why_wait_surgical_waitlists.pdf).
9. Human Resources and Skills Development Canada. Health — patient satisfaction. [Online]. 2005 [cited 2010 Feb 24]. Available from: [http://www4.hrsdc.gc.ca/\\_3ndic.1t.4r@-eng.jsp?iid=7#M\\_1](http://www4.hrsdc.gc.ca/_3ndic.1t.4r@-eng.jsp?iid=7#M_1).

# Seven Questions with Dr. David Naylor, President of the University of Toronto

UBCMJ Staff



*In this photo:* Dr. David Naylor.

President of the University of Toronto since 2005, David Naylor served previously as Dean of Medicine and founding Chief Executive Officer of Toronto's Institute for Clinical Evaluative Sciences. Dr. Naylor has co-authored approximately 300 scholarly publications ranging from health care policy studies to clinical and health services research in diverse specialties. He is a Fellow of the Royal Society of Canada, a Foreign Associate of the US Institute of Medicine, and an Officer of the Order of Canada.

## 1. What was the proudest moment of your life?

I don't have one. I think personal pride is more harmful than helpful, unless perhaps you're a high-performance athlete in a solo sport. As to pride in others, I've been privileged to enjoy many great moments with friends, co-workers and family, and can't readily pick a favourite.

## 2. Tell us about your time in medical school.

I applied to three places but only Toronto offered me a spot. It was a big class then (over 240) and a very traditional program. First year was a grind – lots of smart young people trying to figure out whether to be competitive or collaborative, and lots of memory work. Over the next two years, I skipped lectures, attended labs and clinics, and spent the freed-up time on extra-curricular activities. I became really excited about medicine again in our

final-year clinical clerkship. According to medical sociologists, that attitudinal trajectory was pretty typical in the 1960s and 1970s!

## 3. What would you say is the current direction of health care in Canada?

There isn't one. We've been more or less adrift for almost 15 years. We still have a series of inadequately integrated systems with poorly aligned incentives and suboptimal information technology. Quality management is under-developed and the insights of modern systems science are not being applied consistently to healthcare. It's worrisome.

## 4. Who do you see as a role model and why?

I was fortunate to have several role models and mentors, matched to different phases of my adult life. That said, as you get older, what matters most is to keep learning as life unfolds. There's no shortage of feedback loops if you keep your ego in check and your sensors on.

## 5. What current issue in medicine do you feel is the most pressing right now?

At a systems level, rethinking the health care workforce and changing the education, regulation, and payment of the health professions. At the level of prevention and care, creating clinical and technological platforms to enable wider adoption of personalized medicine based on genomics and related metabolic insights.

## 6. How do you balance your busy schedule and everything outside of work?

I don't. I sleep, exercise and relax less than is wise or healthy. Recent generations of physicians seem to be smarter about carving out time for themselves, their loved ones, and their outside interests. They're better doctors and better people as a result.

## 7. What's next for you?

More than three decades ago, as a medical student, I imagined that it might be exciting to study at Oxford as a Rhodes Scholar, to enter academia as a general internist working in health services research and policy analysis, and maybe even to become President of the University of Toronto. Bizarrely, that's what happened, with an unexpected bonus; I met my wife at Oxford. I have no further ambitions beyond getting my children launched in the world – arguably the most stressful and important thing an adult can do. 

# Case Study: Management of Post-Parotidectomy Neuropathic Pain with Tetrahydrocannabinol:cannabidiol (Sativex)

Patrick T. Yang, BSc<sup>a</sup>, May Ong-Lam, MD<sup>b</sup>

<sup>a</sup>Vancouver Fraser Medical Program 2011, Faculty of Medicine, University of British Columbia, Vancouver, BC

<sup>b</sup>St. Paul's Hospital, Faculty of Medicine, University of British Columbia, Vancouver, BC

## ABSTRACT

Effective treatment and management of neuropathic pain have been limited. Tetrahydrocannabinol:cannabidiol (THC:CBD) endocannabinoid buccomucosal spray (Sativex) is used in this case study to treat a patient suffering from neuropathic pain post-parotidectomy. Furthermore, this particular case study shows that cannabinoids may be effective, at least in part, through a central mechanism to relieve allodynia. This patient's allodynia was treated with Sativex buccomucosal spray. Six weeks later, the patient returned to the clinic with pain symptoms alleviated and transient decrease in alertness as the only side effect experienced. Two years since the initiation of Sativex treatment for allodynia, the patient has not experienced any relapse and is now working and fully functional. This case study demonstrates a successful off-label use of Sativex to treat post-parotidectomy neuropathic pain. Sativex is currently indicated in Canada to treat neuropathic pain only in multiple sclerosis and cancer. This is the first case study to report successful treatment of post-parotidectomy neuropathic pain with THC:CBD (Sativex) buccomucosal spray.

**KEYWORDS:** *Sativex, allodynia, neuropathic pain, tetrahydrocannabinol:cannabidiol*

## INTRODUCTION

Chronic pain commonly causes disability and is a large expense in the health care budget.<sup>1</sup> There is strong evidence that the presence and severity of neuropathic pain in patients are associated with greater impairment in health-related quality of life.<sup>1</sup>

Moulin states that there are three classic symptoms of neuropathic pain, and for each patient, they are present to a variable degree.<sup>2</sup> The first symptom is allodynia, the unusual perception of pain to a stimulus that is usually innocuous. The second is the sensation that an area is "on fire", which is characteristic of a burning dysesthesia. The third is paroxysmal pain, which is commonly fleeting and intense.

The mechanism of persistent chronic central neuropathic pain – a condition in which pain continues to be reported by the patient in the absence of any obvious peripheral damage – is quite complex (Figure 1). This condition usually presents itself following excessive activation of peripheral nociceptors or after

peripheral nerve damage has occurred.<sup>2</sup> There is evidence to support both functional and anatomical changes in the central nervous system (CNS) that might explain neuropathic pain.

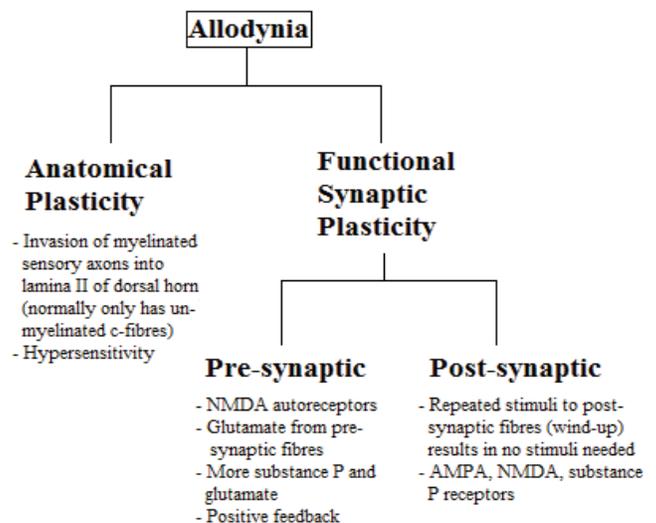


Figure 1. Mechanisms of Allodynia

### Correspondence:

Patrick T. Yang, ppty@interchange.ubc.ca

**Functional Synaptic Plasticity**

This is a mechanism that can be further specified into two categories: pre-synaptic and post-synaptic mechanisms. The pre-synaptic mechanism states that the pre-synaptic NMDA (n-methyl d-aspartic acid) receptors are acting as autoreceptors, stimulated by glutamate released by the pre-synaptic fibres. This would result in an increase release of substance P and glutamate, which would create a positive feedback cycle leading to hypersensitivity and allodynia.<sup>3</sup> The post-synaptic mechanism explains that the response to repeated stimuli by postsynaptic neurons increases over time (or ‘wind-up’) until there is spontaneous activity in the absence of any stimuli. This mechanism may involve AMPA ( $\alpha$ -amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid) and NMDA glutamergic receptors as well as the activation of substance P receptors.<sup>3</sup> Furthermore, Martin *et al.*<sup>4</sup> report that the gamma isoform of protein kinase C is induced in lamina II in injuries that result in allodynia and hyperalgesia.

“ This case study demonstrates a successful off-label use of Sativex to treat post-parotidectomy neuropathic pain.

**Anatomical Plasticity**

In the anatomical mechanism of allodynia and hyperalgesia, myelinated sensory axons sprout and invade lamina II of the dorsal horn. Normally, lamina II is the site of unmyelinated C-fibres that carry pain stimuli. Therefore, the invasion of myelinated sensory fibres into lamina II allows even non-noxious stimuli to activate the pain pathway.<sup>3</sup>

The options for first-line therapy of chronic neuropathic pain include antiepileptics, antidepressants, opioids, and topical local anesthetics.<sup>5-9</sup> However, these agents appear similar in analgesic efficacy and tolerability, despite their differences in mechanism of action.<sup>5-9</sup> Therefore, there is a need for better pain control than is currently available. Thus far, there has been substantial support for the administration of cannabinoids to treat chronic pain and its associated symptoms, such as disability, psychological distress, or sleep pattern changes.<sup>2, 5-9, 10-13</sup>

Cannabinoids suppress neuropathic nociception in animal models of traumatic nerve injury through cannabinoid CB1 and CB2 receptor-specific mechanisms.<sup>14</sup> CB1 receptors are most prevalent in the CNS, and CB2 receptors are predominantly, but not exclusively, outside the CNS.<sup>14</sup> Interestingly, studies of a central mechanism of cannabinoid pain suppression show evidence of CB1 receptor afferents originating supraspinally and anti-allodynic effects being mediated at the level of the spinal cord.<sup>13, 14</sup>

There are very few randomized controlled trials on the use of smoked cannabis. One trial using smoked cannabis to treat

neuropathy in HIV patients showed a 30% pain reduction, in comparison to 15% in the placebo group.<sup>15</sup> However, in a study from Canada, patients with chronic pain treated with inhaled cannabis did not show changes in acute neuropathic pain scores.<sup>16</sup> Overall, it is unlikely that smoked cannabis will be approved by the Food and Drug Administration (FDA) because of a lack of Phase III clinical trials, inconsistent standardization of the drug, and health issues related to smoking. Nonetheless, government approved research programs using standardized herbal cannabis have been approved for chronic pain in Canada.<sup>17</sup>

Oral tetrahydrocannabinol (THC) (dronabinol) was approved in the United States for chemotherapy-associated nausea in 1985; however, it has mixed results with pain relief.<sup>17</sup> Nabilone (Cesamet), a synthetic analogue of THC with greater potency than natural THC, was developed to treat nausea and emesis from chemotherapy.<sup>17</sup> Prior case reports have shown nabilone to be effective for pain relief; however, sedation and dysphoria are prominent side effects.<sup>18</sup>

Tetrahydrocannabinol:cannabidiol (THC:CBD) (Sativex) is administered by spray and contains THC, CBD, minor cannabinoids, and terpenoids, as well as ethanol, propylene glycol excipients, and peppermint flavoring.<sup>17</sup> In Canada, Sativex is approved for multiple sclerosis-related pain and cancer pain but not for post-surgical neuropathic pain. Adverse effects of Sativex include complaints of oral stinging, bad taste, dry mouth, nausea, and dizziness.<sup>17</sup>

This article reviews a case study of a patient whose symptoms were successfully treated with a THC:CBD endocannabinoid system modulator (Sativex) buccomucosal spray after a 14-year history of post-surgical neuropathic pain, where other treatments were ineffective for pain control.

**CASE REPORT**

A 46-year-old Caucasian female presented to the St. Paul’s Hospital Chronic Pain Program in Vancouver, Canada two weeks post-parotidectomy with hypersensitivity to clothing affecting her right neck and shoulder girdle radiating down to the inferomedial border of the scapula. This previously healthy librarian first presented with these specific symptoms 14 years ago when she had her right parotid gland resected due to a benign tumor. Post-surgically, Frey’s syndrome was noted. Furthermore, this patient had right facial palsy and numbness in the distributions of the right V2 and V3 trigeminal nerve as well as sympathetic nervous system involvement. The patient slowly recovered from these post-surgical symptoms over a six-month period. However, the recovery was followed by an awareness of hyperesthesia to clothing involving the right trapezius and parascapular region. Interestingly, pain was specific to clothing and not to touch, temperature variations, or water during showering. Muscle spasms were also noted to develop at this time.

The muscle spasms associated with sensory allodynia were relieved by cyclobenzaprine (Flexeril), 30 mg at bedtime. Furthermore, gabapentin (Neurontin) at 900mg three times daily was partially beneficial in reducing hyperesthesia.

The patient was given multiple modalities of treatment over the past 14 years without significant benefit. Physical modalities such as massage have helped in the short term, but no long term improvements were observed. Acupuncture and moderate physical activity were not helpful. Pharmaceuticals were similarly ineffective. Trials of transcutaneous electrical nerve stimulation (TENS) and botulinum (Botox) injections were performed. Two hundred units of Botox were injected specifically into the trapezium region and then repeated three months later. Although both TENS and Botox relieved symptoms temporarily (three to six months), they lost their efficacy after several re-administrations.

General examination revealed a pleasant lady in no acute distress and had a normal Beck Depression Score. She did not wear clothing above the T2 level due to the allodynia. There was a visible surgical scar from her right parotidectomy. Vitals were stable. Precordial examination was unremarkable. Neurological examinations revealed hypersensitivity to pin prick affecting the right V2 dermatome. There was no facial asymmetry. There were no sensory deficits in terms of allodynia to light touch, temperature, or mechanical pressure. Neurological exams were otherwise normal. Magnetic Resonance Imaging (MRI) and Ultrasound (US) of the right supraspinatus area and cervical spine as well as otolaryngological exam were unremarkable.

The patient was subsequently diagnosed with central neuropathic pain due to misrepresentation of the sensory pathway superimposed upon Frey's syndrome following a right parotidectomy.

Low dose baclofen at 5-10mg twice a day was prescribed for muscle spasms. In addition, Sativex buccomucosal spray was used for pain. Six weeks later, the patient returned with all symptoms alleviated. The patient was using Sativex buccal spray three times per day. All other medications were discontinued. Three years later, treatment doses have not changed, and the patient is back at work and fully functional.

## DISCUSSION

Sativex was one of the first cannabis-based medications to be approved as a prescription medication. It is derived from the extracts of the *Cannabis sativa* plant. The active cannabinoids, THC and CBD, are produced in high yields from this plant. Sativex has been proven to be more effective than placebo in alleviating central neuropathic pain.<sup>7</sup> This particular case study shows that the cannabinoids may be effective in treating post-parotidectomy neuropathic pain.

Barnes<sup>12</sup> describes Sativex as a treatment for both spasticity and neuropathic pain. The ability to treat both these symptoms

proved to be “killing two birds with one stone” in our case study. In just five weeks, our patient returned to the St. Paul's Chronic Pain Program Clinic with remarkable results. After 14 years, her symptoms had resolved with three sprays of Sativex per day: one spray in the morning at eight followed by a second spray at noon and then another at six in the evening. The only side effect noticed by the patient was temporary episodes of decreased alertness one hour after each spray, lasting for approximately 30 minutes. There has been no relapse of symptoms after three years, and she is very pleased with her response to the medication.

To our knowledge, this is the first case of post-parotidectomy neuropathic pain treated successfully with Sativex. In conclusion, Sativex may be an effective treatment for post-parotidectomy neuropathic pain refractory to other treatments. 

“ There is strong evidence that the presence and severity of the neuropathic pain in patients are associated with greater impairment in health-related quality of life. ”

## REFERENCES

1. Jensen MP, Chodroff MJ, Dworkin RH. The impact of neuropathic pain on health-related quality of life: review and implications. *Neurology*. 2007 Apr 10;68(15):1178-82.
2. Moulin DE. Medical management of chronic nonmalignant pain. In: Campbell JN, editor. *Pain 1996 - an updated review*. Seattle, Wash: IASP Press; 1996. p. 485-91.
3. Doubell TP, Mannion RJ, Woolf CJ. The dorsal horn: State-dependent sensory processing, plasticity and the generation of pain. In: *The textbook of Pain 4 Edition* (Edited by: Wall PD, Melzack D). London: Churchill Livingstone 1999, 165-182.
4. Martin WJ, Malmberg AB, Basbaum AI. PKC- $\gamma$  contributes to a subset of the NMDA-dependent spinal circuit that underlie injury-induced persistent pain. *J Neurosci*. 2001 Jul; 21(14):5321-7.
5. Mao J, Warner M. Emerging strategies for the treatment of neuropathic pain. *Anesthesiology* 2007 Mar; 106(3):642.
6. Moulin DE, Clark AJ, Gilron I, Ware MA, Watson CP, Sessle BJ, *et al*. Canadian Pain Society. Pharmacological management of chronic neuropathic pain - consensus statement and guidelines from the Canadian Pain Society. *Pain Res Manag*. 2007 Spring;12(1):13-21.
7. Iskedjian M. Meta-analysis of cannabis based treatments for neuropathic and multiple sclerosis-related pain. *Curr Med Res Opin*. 2007 Jan; 23(1):17-24.
8. Nurmikko TJ, Serpell MG, Hoggart B, Toomey PJ, Morlion BJ, Haines D. Sativex successfully treats neuropathic pain characterized by allodynia: a randomized, double blind, placebo-controlled trial. *Pain*. 2007 Dec 15;133(1-3):210-20.
9. Sagar DR, Kelly S, Millns PJ, O'Shaughnessy CT, Kendall DA, Chapman V. Inhibitory effects of CB1 and CB2 receptor agonists on responses of DRG neurons and dorsal horn neurons in neuropathic rats. *Eur J Neurosci*. 2005;22:371-379.
10. Varvel SA, Wiley JL, Yang R, Bridgen DT, Lomg K, Lichtman AH, *et al*. Interactions between THC and cannabidiol in mouse models of cannabinoid activity. *Psychopharmacology* 2006; 186:226-234.

11. Russo EB and McPartland JM. Cannabis is more than simply Delta(9)-tetrahydrocannabinol. *Psychopharmacology* 2003; 165: 431-2.
12. Barnes, M. Sativex: Clinical efficacy and tolerability in the treatment of symptoms of multiple sclerosis and neuropathic pain. *Expert Opin Pharmacother.* 2006 Apr; 7(5): 607-15.
13. Walker JM and Hohmann AG. Cannabinoid mechanisms of pain suppression. *Handb Exp Pharmacol.* 2005; (168):509-54.
14. Rahn EJ, Makriyannis A and Hohmann AG. Activation of cannabinoid CB1 and CB2 receptors suppresses neuropathic nociception evoked by the chemotherapeutic agent vincristine in rats. *Brit J Pharm.* 2007,1-13.
15. Abrams DI, Jay CA, Shade SB, Vizoso H, Reda H, Press S, *et al.* Cannabis in painful HIV-associated sensory neuropathy: a randomized placebo-controlled trial. *Neurology.* 2007 Feb 13;68(7):515-21.
16. Ware M, Wang T, Shapiro S, Ducruet T, Robinson A, Gamsa A, *et al.* Smoked cannabis for chronic neuropathic pain: results of a pilot study. 17th Annual Symposium on the Cannabinoids. Saint-Sauveur, Quebec, Canada: International Cannabinoid Research Society; 2007. p. 31.
17. Russo EB. Cannabinoids in management of difficult to treat pain. *Ther Clin Risk Manag.* 2008;4(1):245-259.
18. Berlach DM, Shir Y, Ware MA. Experience with synthetic cannabinoid nabilone in chronic noncancer pain. *Pain Med.* 2006;7(1): 25-9.
19. Zajicek JP, Sanders HP, Wright DE, Vickery PJ, Ingram WM, Reilly SM, *et al.* Cannabinoids in multiple sclerosis (CAMS) study: safety and efficacy data for 12 months follow up. *J Neurol Neurosurg Psychiatry.* 2005 Dec;76(12):1664-9.
20. Wade DT, Makela PM, House H, Bateman C, Robson P. Long term use of cannabis-based medicine in treatment of spasticity and other symptoms of multiple sclerosis. *Mult Scler.* 2006;12(5): 639-45.
21. Russo EB. The solution to the medicinal cannabis problem. In: Schatman ME, editor. *Ethical issues in chronic pain management.* Boca Raton, FL: Taylor and Francis; 2006. p. 165-194.



## Join the Adventure!

Imagine where a Clinical Research Project  
in Pediatric Surgery could take you.



- Partnership
- Skill
- Discovery
- Service
- Achievement

The Office of Pediatric Surgical Evaluation & Innovation at BC Children's Hospital  
is a proud supporter of Medical Student Research.

[www.opsei.bc.ca](http://www.opsei.bc.ca)

# MAKING CONNECTIONS: SELECT SUBMISSIONS



My World by a Student with Autism



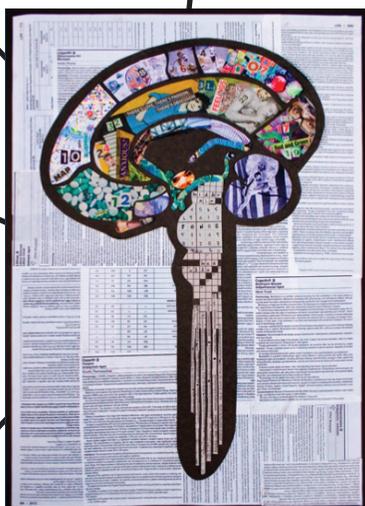
Hallucination by Nima Kashani



Temporal Lobe by Nima Kashani



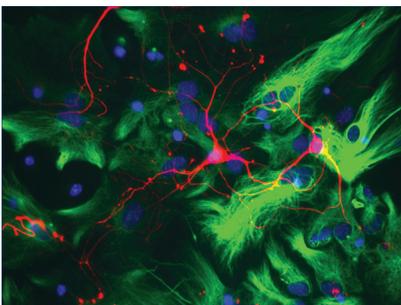
Short Circuit by Irvin Janjua



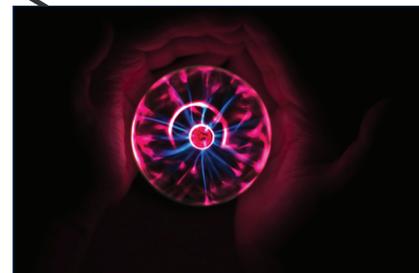
On the cover: Corpus Collagesome by Lindsay Stokvis



Brain Branches by Irvin Janjua



We All Come From the Cortex by Miranda Witheford



Cell Body by Irvin Janjua

To learn more about this contest and see even more images, visit [www.corpuscallawesome.com](http://www.corpuscallawesome.com).



Light-Headed by Cyrus McEachern



Flower Spray Ending in Axo-axonic Synapse by Florina Feng



Fading Memories of the Demented by Gil Eamer



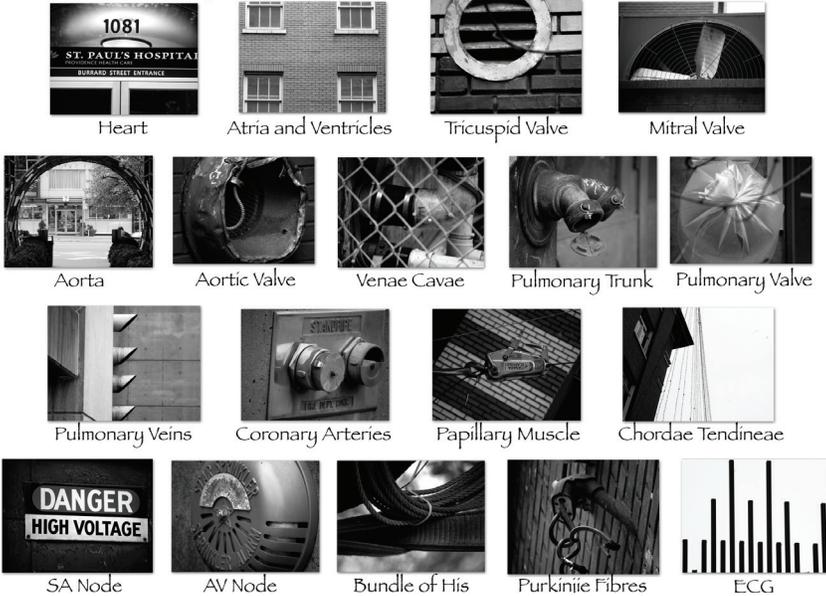
Corona Radiata by Erin Kennah

# HEARTFELT IMAGES CONTEST 2010

## Photo Category Winners:

A special Thank You to Dr. Carol-Ann Courneya for these images.

"The Heart Centre at St. Paul's is known around the world for its work in the prevention of heart disease and for the care, treatment and support of people living with heart conditions."



Heart      Atria and Ventricles      Tricuspid Valve      Mitral Valve

Aorta      Aortic Valve      Venae Cavae      Pulmonary Trunk      Pulmonary Valve

Pulmonary Veins      Coronary Arteries      Papillary Muscle      Chordae Tendineae

SA Node      AV Node      Bundle of His      Purkinje Fibres      ECG

### St. Paul's Hospital by Kerry Walker

"St. Paul's is widely known for the extraordinary care in the field of cardiology. My grandfather is alive today because of the advances in research and level of care that St. Paul's provides, thus I found it fitting to represent the hospital itself as the heart of cardiology with each photo being part of the external structure of the building." - Kerry



With Snowing Hearts (Spirit of the Olympics) by Alvin Cheung



Truncus Ateriosus by Alma Bencivenga

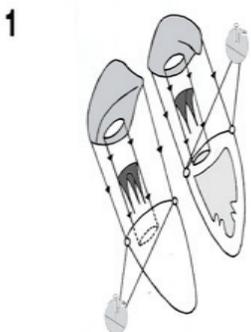
## Other Media Category Winner:

HJÄRTA

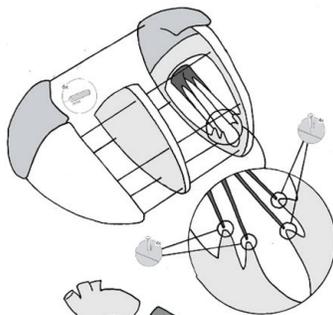
by Gordon Kirkpatrick



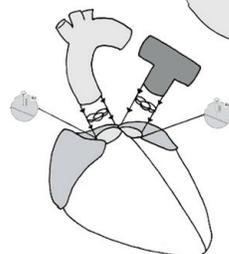
- You will need:
- 2 Atria
  - 2 Ventricles
  - 1 Interventricular Septum
  - 2 Semilunar Valves
  - 1 Tricuspid Valve
  - 1 Bicuspid Valve
  - 1 Aorta
  - 1 Pulmonary Trunk
  - 4 Pulmonary Veins
  - 1 Superior/Inferior Vena Cava



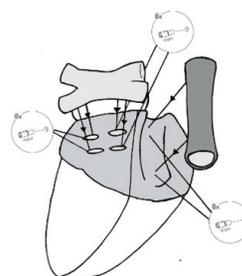
2



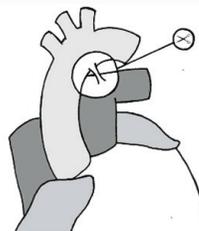
3



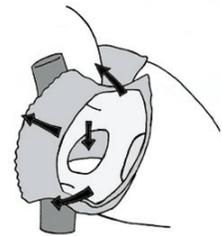
4



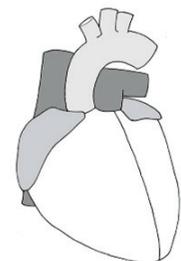
5



6



7



Disclaimer: IKEA does not accept any responsibility for Congenital Heart Defects, including but not exclusive to: PDA, ASD, VSD, Valve Defects, Coarctation of the Aorta, Tetralogy of Fallot or Transposition of the Great Arteries

# Thank you from the UBCMJ

## SPONSORS

*Platinum*



Michael Smith Foundation for  
**Health Research**



## SUBSCRIPTIONS

*Grand Benefactors*

Dr. John Challis  
Dr. Berhard Toews  
Wynn Spencer

*Patrons*

Dr. Lawrence Burr

For sponsorship inquiries, please contact [sponsorships@ubcmj.com](mailto:sponsorships@ubcmj.com). To subscribe to the UBCMJ, please contact [subscriptions@ubcmj.com](mailto:subscriptions@ubcmj.com). Visit our website at [www.ubcmj.com](http://www.ubcmj.com) for more information.

**We're here for you 24 hours a day,  
seven days a week.**



**24-Hour Help Line**  
**1-800-663-6729**  
[www.physicianhealth.com](http://www.physicianhealth.com)

The Physician Health Program of British Columbia offers help to BC physicians, residents, medical students and their immediate families for a wide range of personal and professional problems: physical, psychological and social. If something is on your mind, give us a call.



**Physician  
Health Program**  
British Columbia

Connecting Physicians to Health