



**Institute for Rehabilitation Research and Development
The Ottawa Hospital Rehabilitation Centre**

2009 Rehab Research News



**The Ottawa Hospital | L'Hôpital
d'Ottawa**

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I am pleased to present the first issue of the Institute for Rehabilitation Research and Development (IRRD) *Rehab Research News*. This new format for reporting our activities replaces our annual research and development report, the first of which was produced in 1988. Since that time, there have been many administrative changes related to the way in which research is done at IRRD. The details of these changes are outlined elsewhere in this report. I am happy to report that in spite of these many changes, research continues to flourish at IRRD.

The focus of our research and development efforts is the ultimate improvement of the lives of the clients we serve at The Ottawa Hospital Rehabilitation Centre (TOHRC). Virtually all disciplines are involved in research, much of our research is interdisciplinary in nature, and we have a special focus on evidence-based practice and maintaining a high ethical standard for our research activities.

I would like to thank our Acting Psychiatrist-in-Chief, Dr. Sue Dojeiji, for her strong support of all aspects of our research program. The Clinical Director of Rehabilitation and Family Health Teams, Helen Zipes, has also been a strong and dedicated advocate for research - in particular, the translation of research into practice. We also enjoy the commitment and support of our Clinical Vice-President, Cameron Love, the CEO, Dr. Jack Kitts, and the entire Senior Management Team of The Ottawa Hospital (TOH). There is a strong commitment to clinically relevant research at TOH, and this commitment clearly extends to TOHRC.

We are also very fortunate to be associated with the Ottawa Hospital Research Institute (OHRI). All of our research projects are effectively and efficiently administered through OHRI and, as well, all of our projects are reviewed and monitored by the Ottawa Hospital Research Ethics Board. In particular, I would like to thank the President and CEO of OHRI, Dr. Duncan Stewart, for his support and, a special mention to Rob Hanlon, COO, and his staff who have provided invaluable support and advice throughout our development.

The Ottawa Hospital Foundation, through the leadership of Susan Doyle, has also been a consistent supporter of our activities and we look forward to working closely with the Foundation in the coming year, particularly in the effort to raise funds for the exciting new Rehab Virtual Reality Lab.



I would also like to thank the dedicated researchers, most of whom balance excellent research and very demanding clinical schedules. I am certain the clinical work makes for better research and conversely, that research makes for better clinical practice.

I am also very fortunate to have a hard-working and dedicated team in the IRRD office who support all our activities on a daily basis. Dorothyann Curran and Carolyn Cook both do invaluable work and I welcome my new secretary, Tina Hutchinson. I would also like to thank my former secretary, Chrissie DeCurtis, who has moved to an exciting new job in the Communications Department of TOH.

Finally, I thank all of the patients and families at the hospital for their participation in our research efforts. We do our research to benefit them, and we are very pleased at their enthusiasm for and willingness to participate in our research projects.

DR. JAMIE MACDOUGALL

Director, Institute for Rehabilitation Research and Development
The Ottawa Hospital Rehabilitation Centre

“TO PROVIDE EACH PATIENT WITH THE WORLD-CLASS CARE, EXCEPTIONAL SERVICE AND COMPASSION THAT WE WOULD WANT FOR OUR LOVED ONES”

- The Ottawa Hospital Vision

Our Institute for Rehabilitation Research and Development (IRRD) plays a large part in helping fulfill this new vision for The Ottawa Hospital (TOH), as evidenced by the many contributions made by our researchers, clinicians and staff toward pursuing clinically relevant new knowledge and best practice.

Of special note this past year has been the partnership with the Canadian Forces Health Group in the procurement and construction of its first Rehab Virtual Reality Lab at The Ottawa Hospital Rehabilitation Centre (TOHRC). We are all very excited about this project and the many positive outcomes it will have for Canadian Forces patients and for other regional patients, who will have the opportunity to take advantage of the latest technology for physical and mental rehabilitation. Our site was chosen for this lab largely due to the Canadian Forces' interest in capitalizing on the strengths of the researchers at TOHRC and the IRRD.

We congratulate and thank Dr. Jamie MacDougall and his team for their outstanding achievements and work, which are highlighted in this report. The collaboration and partnerships with other investigators regionally, nationally and internationally is very impressive and highlights the recognition and reputation of our Research Institute.



HELEN ZIPES
Clinical Director, Rehabilitation Program
The Ottawa Hospital



DR. SUE DOJEJI
Acting Physiatrist-in-Chief
The Ottawa Hospital Rehabilitation Centre

RESEARCH AND DEVELOPMENT AT THE OTTAWA HOSPITAL REHABILITATION CENTRE

VISION

The pursuit of excellence in rehabilitation research and development.

MANDATE

- To conduct clinical and community research with high relevance to TOHRC and the broader rehabilitation community.
- To provide advice on and assistance with research methodology and data analysis/interpretation to TOHRC staff engaged in research, program evaluation and best practice review and implementation.
- To conduct research on, develop and oversee knowledge transfer within TOHRC for best practice.
- To develop, plan and oversee networking activities at the regional and national levels to enhance knowledge dissemination.
- To exchange knowledge and expertise for the benefit of the international rehabilitation community.
- To leverage the expertise, products and services of IRRD/TOHRC to generate revenue to support research and development activities and initiatives.
- To develop and research new technologies that improve the lives of persons with rehabilitation needs.

HISTORY

From the beginning, the Research Department of The Rehabilitation Centre (TRC) fostered interdisciplinary research efforts that emphasized clinical outcomes, while at the same time addressed fundamental research issues. In support of this pursuit, the first Labatt 24-Hour Relay was held in 1989. This fund was to be instrumental in launching many pilot studies and provided rehabilitation researchers the impetus for seeking external grants.

In April 1992, the Research Department at TRC officially became the Institute for Rehabilitation Research and Development (IRRD). Our mandate expanded to include the promotion of networking and partnerships at the university level, as well as with other rehabilitation centres across Canada. In addition, international development and commercialization became an important focus for IRRD. The aim was to share our clinical and research expertise worldwide and provide hands-on training opportunities to underdeveloped countries.

A Cooperation Agreement between IRRD and The University of Ottawa was signed in 1994, the objective of which was to encourage professional exchange and collaboration between academic and clinical researchers. In this same year, the Consumer-Researcher Partnership Forum was held. This forum provided an excellent opportunity to examine methods for facilitating collaborative research partnerships between consumers and researchers.

Through the late 1990's, many industrial partnerships along with national and international development projects were initiated. IRRD was incorporated in August 2000, and was later officially launched as such in December 2000 by Prime Minister Jean Chrétien and actor Christopher Reeve.

In 2005, a memorandum of understanding was signed between IRRD, Queen's University at Kingston and Kobe Gakuin University in Japan to foster cooperative education and research initiatives. In April 2005, governance of The Rehabilitation Centre was transferred from the Royal Ottawa Health Care Group to the newly amalgamated Ottawa Hospital. A year later, the incorporated IRRD was consolidated as a Centre within the Clinical Epidemiology Program of The Ottawa Hospital Research Institute (OHRI).

The staff and researchers of IRRD continue to strive to acquire knowledge across the spectrum of research in rehabilitation, from basic science to clinical outcome trials and population-based health outcome studies. We are committed to finding new and innovative methods of delivering knowledge to the clinician and the consumer, and to helping people with disabilities achieve full integration and participation in all aspects of life.

SPECIALIZATION WITHIN IRRD

As IRRD has evolved over the past decade, the opportunity and need for specializations in research emerged. We have been fortunate that our staff have been well qualified to meet the needs of new research trends.

Research Ethics

Research ethics is a growing field. Dorothyann Curran received a Master's degree in Bioethics from the University of Toronto in 2005. Prior to the merger of hospital policies and procedures, she served on the Research Ethics Board of The Rehabilitation Centre for eight years. Her growing expertise in research ethics is maintained by consultations with rehabilitation staff researchers and collaborations with the Clinical Ethicist of TOH. She is also a member of the Ottawa Hospital Research Ethics Board Executive.

Quality Initiatives and Quality Reporting

Carolynn Cook has a Master of Science degree in Psychology (Specialization in Neuroscience) from Carleton University. Over the past decade, she has been responsible for managing data for quality reporting and quality improvement activities related to rehabilitation within The Ottawa Hospital. She provides data analysis and specific report formats for clinicians and clinical managers on a regular basis using internal data, and data from the National Rehabilitation Reporting System (NRS). Through this database management, she is also an important resource for clinicians working on evidence-based research and best practice initiatives.



Core IRRD Staff (left to right): Dorothyann Curran, Research Associate; Dr. Jamie MacDougall, Director of Research; Tina Hutchinson, Secretary; Carolynn Cook, Research Associate



Rehabilitation Engineering Solutions

Team Members: JOAO TOMAS, Electronics Technologist; SHAWN MILLAR, Electronics Technologist; PATRICIA O'NEILL, Research Engineer; TONY ZANDBELT, Mechanical Technologist; DEBRA-LYNN POIRIER, Secretary; LOUIS GOUDREAU, Clinical Engineer

Rehabilitation Engineering collaborates with many areas of TOHRC to create engineering solutions for unique problems in accessibility, client care and research. The following projects are highlights of our 2009 activities.

DEVICES DEVELOPED FOR ACCESSIBILITY IN LIVING

Custom Communication Device Cover

A protective casing with a clear window was designed to cover the viewing screen on a Dynavox VMax communication device. The protective window prevents the touch-sensitive screen from being activated unintentionally. The casing also protects the speakers from rain, and the cover can be removed easily and safely by sliding it over the device.



Accessible Remote Control for Window Blinds



The Independent Living Unit (ILU) at TOHRC allows clients to test their ability to manage on their own. Over time, it became clear that the buttons on the remote control used for operating automated blinds were too small and difficult to access for many clients. To solve this problem, we purchased a remote from the manufacturer (shown in white and blue) with three large blue buttons for controlling the "up", "down" and "stop" functions. In addition, we mounted three larger button switches (yellow and red) for clients having difficulty operating the white and blue remote.

Snowmobile Foot Brake

Our client had difficulty using the hand brake on the left side of his snowmobile. We designed and installed a cabled, foot-operated brake pedal to accommodate hands-free braking.





Accessible Infant Car Seat

As primary caregiver, this parent needed to be able to independently and safely move his infant in and out of a car seat from his manual wheelchair. Putting the car seat on the van seat was not an option, as it was too high and out of reach for the client. The height of the car seat had to be low enough for the client to access the seat from outside the minivan from his wheelchair. To do so, one of the rear seats was removed and the base was used to attach the custom pivoting car seat system to the van floor. This system allows the seat to pivot from the rear facing position for travelling (lower right photo) to the sideways position for access (upper left photo). Each position locks in place and can be unlocked by the parent using a latch that is under the seat, well out of reach of the child.



Enhanced Vehicle Console Lighting

A client had difficulty seeing the individual labels on a 14 button custom remote secondary driving control. Several attempts were made to improve the lighting, but none was sufficient. A custom strip with miniature green LEDs on both sides was made and positioned down the centre of the two columns of buttons. The intensity of the light is adjustable, allowing the client to read the labels in different lighting conditions.



Accessible Infant Crib

For many years Rehabilitation Engineering has been customizing infant cribs to make them wheelchair accessible. In 2009, three accessible cribs were loaned to new parents. In addition, a fourth crib was made accessible to increase the number of cribs available for loan.

EQUIPMENT TO ENHANCE DELIVERY OF CARE

Reaction Timer Upgrade for Driver Assessments

When a person's driving is assessed at TOHRC, a driving simulator is used to measure how long a person takes to react to different signals, such as turning and braking. The original reaction timer was custom-made over 20 years ago and has needed frequent servicing. The upgraded system, now based on a programmable microcontroller, has all the original functions with added capabilities for future changes and enhancements.



Ergonomic Solutions for Clinicians

We also provide engineering services to other areas of TOH through the Occupational Health, Safety, and Emergency Preparedness department. We have developed custom devices for staff recovering from repetitive strain injuries, as well as devices designed to help prevent them. For example, several ultrasound probe adaptors have been made that provide a more ergonomic grip for clinicians.



Improvements to Height Adjustable Parallel Bars

The Prosthetics and Orthotics Department uses parallel bars to support clients during walking assessments. Each time an individual client is assessed, the bars need to be adjusted according to his/her height, a procedure that is time consuming and requires more than one person. With the help of a group of Algonquin College Mechanical Technology students, a crank mechanism was added to allow for quick, easy and safe raising and lowering of the bars by a single person.

INSTRUMENTATION AND DEVICES TO TAKE REHABILITATION RESEARCH FURTHER

Stacked Breath Counters

Rehabilitation Engineering developed a device that counts the number of stacked breaths using a modified resuscitation bag. The counter is used by Dr. Doug McKim and his team in the Pulmonary Lab to train patients to use the stacked breath technique to increase their lung volume. The device is activated when two miniature adjustable pressure switches are closed. One switch will close when a minimum pressure threshold is detected at the mouthpiece; the second switch will close when a minimum pressure threshold is detected at the bag. It is only when both switches are closed that a count is recorded. The device will not count stacked breaths if there is an inadequate seal at the mouthpiece or if the bag is unintentionally squeezed. The recorded data can be downloaded using a USB interface, and Windows software specifically designed to log the event data.



Electronic Arthrometer

Several years ago, we developed a mechanical instrument to measure rat knee angular displacement at various soft tissue loads, under normal and pathological circumstances, for research studies lead by Dr. Guy Trudel. An electronic version of this instrument was recently developed, which provides controlled accurate automatic application of the four torque levels and a digital readout of the knee joint angle.



Portable Ramp with Adjustable Slope

A commercial portable ramp was modified to allow quick slope changes between 1:10, 1:12 and 1:16 grades. A self-braking belay descender device and mounting climbing rope were the basis for a wheelchair safety tether system. This ramp was used to study the Effect of Snow and Ice on Exterior Ramp Navigation by Wheelchair Users, a project conducted by Dr. Ed Lemaire.





Clinical Research Activities in Nursing

CO-PRINCIPAL INVESTIGATORS: Toba Miller and Andrea Fisher



Coinvestigators: SUSAN DRAPER, Bruyère Continuing Care; KELLY LUMLEY-LEGER, The Ottawa Hospital; RYAN MCNEIL, The Ottawa Hospital Research Institute; CONNIE SCHULZ, The Ottawa Hospital; LISA FREEMAN, The Ottawa Hospital; SHERRY MITCHELL, The Ottawa Hospital

KNOWLEDGE TRANSLATION OF EVIDENCE-BASED RECOMMENDATIONS FOR CONTINENCE CARE OF STROKE PATIENTS IN ACUTE AND REHABILITATION SETTINGS *(Funded by Ontario Stroke Strategy Grant, Ontario Ministry of Health and Long Term Care)*

Bladder dysfunction post-stroke may have a significant impact on the well-being of stroke survivors and care givers. The impact of urinary incontinence on patients has been shown to have an adverse effect on stroke survival, disability and institutionalization rates. Urinary incontinence and retention are common problems following a stroke. Clinical practice guidelines (CPGs) for stroke care recommend that nurses from all practice settings assess stroke patients for urinary problems. However, these guidelines do not include evidence-based recommendations (EBR) for continence management.

A nurse-led research team conducted a systematic review of the literature to obtain published and non-published information about urinary practices for stroke and geriatric patients. Experts in stroke, geriatric, and continence care were also contacted to obtain further information regarding best practices. Clinical practice guidelines for urinary continence management post-stroke were developed by the research team and in consultation with nurse experts in continence management. Selected CPGs for continence care of stroke patients were implemented in acute and rehabilitation settings, and an evaluation was done on the nurses' uptake. The overall goal was to improve clinical practice and nurses' knowledge regarding the continence care challenges of stroke survivors through the integration of best evidence.

AN ONLINE SELF-DIRECTED LEARNING PORTAL SUPPORTING THE IMPLEMENTATION OF STROKE CARE CLINICAL PRACTICE GUIDELINES *(Funded by Ontario Stroke Strategy Grant, Ontario Ministry of Health and Long Term Care)*

Online self-directed learning has the potential to distribute evidence-based recommendations to a wide audience at a low cost to clinical practice guideline (CPG) developers. An online self-learning portal was developed to support the implementation of CPGs for the urinary continence care of stroke survivors by nurses and other health professionals. The online self-learning portal includes interactive learning modules integrating evidence-based recommendations, case scenarios, learning assessments, and links to supporting information, such as assessment tools and protocols. The self-learning portal uses a WordPress blogging platform which allows participants to comment on the modules and seek feedback on urinary continence care. The relative low cost of this platform might be of particular interest to health settings interested in using online self-learning tools, while limiting learning expenditures.

An evaluation of the online self-learning portal concluded in February 2010. The research team partnered with national and international nursing associations to recruit nurses to participate in the evaluation. Participants were asked to complete the online self-learning portal, as well as surveys assessing baseline knowledge, post-intervention knowledge, and evaluation of the online self-directed learning portal.

OVERCOMING BARRIERS TO PROVIDING EVIDENCE-BASED PRESSURE ULCER MANAGEMENT FOR HOSPITAL INPATIENTS: AN IMPLEMENTATION PROJECT *(Funded by The Ottawa Hospital Centre for Patient Safety)*

A pressure ulcer is a localized injury to the skin and/or underlying tissue. Skin breakdown and the development of a pressure ulcer adversely impact the patient, clinician and the health-care system. The clinical and financial costs are substantial. Patients who develop a pressure ulcer experience suffering, can have an increased hospital stay, and have a diminished quality of life. The treatment of pressure ulcers consumes additional materials and human resources. The pressure ulcer prevalence ratio reflects the calibre of safety of a health-care organization. Addressing the problem of hospital-acquired pressure ulcers is essential to improving patient safety and appropriateness of care.

The Ottawa Hospital (TOH), in its commitment to ensure quality health-care practices, has conducted an annual pressure ulcer prevalence (PUP) study involving inpatients for over a decade. For the last five years, the overall mean prevalence rate has remained relatively constant at 15%. This rate is lower than similar acute care organizations in Canada which are reported to range from 24% to 26%. However, given the unchanged prevalence rate and the growing acuity of the hospitalized patient population, there is an urgent need to move beyond the traditional approach and embrace innovative strategies.

Addressing this health-care safety issue is difficult because multiple factors contribute to pressure ulcer development. This quality improvement safety pilot project aims to

discover TOH specific factors contributing to pressure ulcer development and to pilot an interprofessional evidence-based intervention. This two-phase project consists of 1) a needs assessment to identify practice barriers and 2) the development, implementation and evaluation of an interprofessional evidence-based tailored intervention.

EVALUATION OF DIABETES FOOT CARE EDUCATION AT THE OTTAWA HOSPITAL REHABILITATION CENTRE *(Funded by Johnson & Johnson Nursing Research Award)*

Foot complications can be a serious problem for some people with diabetes. The Ottawa Hospital is committed to the ongoing development of evidence-based nursing policy, procedures and practice. The implementation of evidence-based practice is associated with improved efficiencies, clinical outcomes and reduced costs to health-care systems. Specifically, the literature indicates that assessments of foot ulcer risks and patient education aimed at early identification of problems and implementation of appropriate self-care practices can reduce the incidence of foot ulceration in persons living with diabetes. The majority of amputations in persons with diabetes are preceded by foot ulcers. Strategies that help reduce patients' risk for future foot ulcers are very important for quality care and patient safety. An inpatient unit at The Ottawa Hospital Rehabilitation Center implemented the RNAO best-practice guideline "Reducing Foot Complications for People with Diabetes" (RNAO 2004). The implementation evaluation included an appraisal of the educational approaches to support nurses' uptake of the guideline information and patients' perceptions of the teaching content.

2009 CONFERENCE PRESENTATIONS

Fisher A, McNeil R, Miller T, Draper S, Lumley-Leger K. An online self-directed learning portal supporting the implementation of stroke care clinical practice guidelines. Poster Presentation at the Canadian Association of Neuroscience Nurses, 40th Annual Scientific Sessions, Halifax, Nova Scotia, June 2009.

Fisher A, McNeil R, Miller T, Draper S, Lumley-Leger K. An online self-directed learning portal supporting the implementation of stroke care clinical practice guidelines. Poster Presentation at the Canadian Association of Rehabilitation Nurses Conference, Winnipeg, Manitoba, June 2009.

Miller T, Freeman L. Conducting a pressure ulcer study in a rehabilitation facility. Poster Presentation at the Canadian Association of Wound Care Conference, Quebec City, Quebec, October 2009.

Miller T, Shalla D. Conducting a pressure ulcer study in a rehabilitation facility. Poster Presentation at the Canadian Association of Rehabilitation Nurses Conference, Winnipeg, Manitoba, June 2009.

Miller T, McNeil R, Fisher A, Draper S. Urinary continence best practice guidelines for stroke survivor inpatients on rehabilitation units. Invited Speaker to the 30th Annual Meeting of the Inter-Urban Stroke Academic Association, London, Ontario, April 2009.

Miller T, Brez S, Daigle S. Preventing diabetic foot complications: Successes and challenges of a pilot study in an inpatient rehabilitation facility. Poster Presentation at the Canadian Association of Rehabilitation Nurses Conference, Winnipeg, Manitoba, June 2009.



Rehab Technology to Enhance Mobility

PRINCIPAL INVESTIGATOR: Edward Lemaire

Coinvestigators: JONATHAN KOFMAN, University of Waterloo; NATALIE BADDOUR, University of Ottawa, ADRIAN CHAN, Carleton University; GORDON ROBERTSON, University of Ottawa; BERNARD HUDGINS, University of New Brunswick; PETER KYBERD, University of New Brunswick; M JASON HIGHSMITH, University of South Florida; WIELAND KAPHINGST, Bauerfeind AG (Germany); JORGE A VÉLEZ, Colombian Telemedicine Centre; LORENA NIETO SERNA, Colombian Telemedicine Centre; MARKUS BESEMANN, Canadian Forces Health Services Group; FANGWEI ZENG, International Society for Prosthetics and Orthotics

EFFECT OF SNOW AND ICE ON EXTERIOR RAMP NAVIGATION BY WHEELCHAIR USERS *(Funded by the Canada Mortgage and Housing Corporation)*

Wheelchair users are particularly affected by snow and ice conditions since previously accessible facilities can become inaccessible in cold weather. This study was the first quantitative analysis of wheelchair mobility on ramps under winter conditions. Eleven manual wheelchair users ascended an exterior ramp at 1:10, 1:12, 1:16 slopes, under packed snow and “packed snow with a freezing rain cover and traction grit” conditions. Vicon motion tracking, video, and questionnaire data were collected to assess biomechanics and subject perceptions. This study confirmed that independent navigation cannot be assumed for all conditions and all ramp grades accepted under current building codes. All subjects were able to complete the ice-grit conditions independently at all ramp slopes. For snow conditions, the 1:10 grade was insurmountable for many subjects without assistance. The 1:16 grade was preferred for winter ramp navigation. For snow conditions, the transition area from level ground to the ramp incline was the most difficult to traverse. Backwards ramp ascent should be considered for people with sufficient shoulder and trunk range of motion. For ice-grit ramp navigation, two-railing propulsion was preferred due to enhanced trajectory control and reduced wheel slip problems. The amount of grit required and the effective time (i.e., time when embedded grit becomes much less effective) should be addressed in further research. Typical front wheels are

not designed for soft snow conditions and few options exist to address this need. As the first biomechanical evaluation of wheelchair ramp navigation, the outcomes from this study provide a better understanding of wheelchair user strategies for dealing with ramps in winter.

THE BLACKBERRY SMARTPHONE AS A PLATFORM FOR WEARABLE MOBILITY MONITORING *(Funded by Ontario Centres of Excellence and Research In Motion)*

Monitoring the mobility of people with physical disabilities is an important part of rehabilitation medicine. A Wearable Mobility Monitoring System (WMMS) that can monitor mobility within the home environment and the community for a long period could be a valuable tool for clinical professionals. Current available technologies, such as small accelerometers and the new generation of Blackberry handheld devices, provide a great opportunity to create such a system. Our preliminary research resulted in a WMMS running on the BlackBerry 9000 and a custom designed “Smart Holster” that contained an accelerometer, light sensor, and temperature/humidity sensor. This system performed well for identifying activities and the context of the mobility state by fusing the sensor information (acceleration, light intensity, GPS) to determine a change of state and then having the SmartPhone camera take a picture for analysis.

STANCE CONTROL KNEE ANKLE FOOT ORTHOSES

(Funded by the Canadian Institutes of Health Research)

Conventional knee-ankle-foot orthoses (KAFOs) are prescribed for people with knee-extensor muscle weakness. However, these orthoses lock the knee in full extension and, therefore, do not permit a natural gait pattern. Our research has resulted in two new orthosis designs that improve walking by allowing free knee motion during swing and other non-weight-bearing activities and resist knee flexion, while allowing knee extension during weight bearing. The Ottawalk stance-control knee-ankle-foot orthosis (SCKAFO) employs a novel friction-based belt-clamping mechanism. This design works with a variety of control methods, such as mechanical push-rod and electronic sensor systems, to determine when the person is bearing weight on their leg and then engaging safety mode to stop the knee from collapsing. The Ottawalk-Speed SCKAFO uses a novel angular-velocity control method to activate safety mode (i.e., resisting knee flexion when weight bearing). This approach is based on the premise that knee-flexion angular velocity during a knee-collapse event, such as a stumble or fall, is greater than that during walking. When the angular-velocity threshold is passed, hydraulics are used to resist knee flexion. The Ottawalk-Speed device does not require an external control mechanism to switch from free motion to stance control mode. Functional test results demonstrated that the hydraulic angular-velocity activated knee joint provided free knee motion during walking, engaged upon knee collapse, and supported body weight while the end-user recovered to a safe body position. The hydraulic, angular velocity activation approach has potential to improve safety and security for people with lower extremity weakness or when recovering from joint trauma.

SELECTED PUBLICATIONS

- Lemaire ED, O'Neil P, Desrosiers M, Robertson G. Effect of Snow and Ice on Exterior Ramp Navigation by Wheelchair Users. Canada Mortgage and Housing Corporation, 2009.
- Kendell CL, Lemaire ED, Dudek NL, Kofman J. Indicators of dynamic stability in transtibial prosthesis users. *Gait and Posture* 2010;21(3):375-379.
- Biswas A, Lemaire ED, Kofman J. Dynamic gait stability index based on plantar pressures and fuzzy logic. *Journal of Biomechanics* 2008;41(7):1574-1581.
- Lemaire, ED, Goudreau L, Yakimovich T, Kofman J. Angular-velocity control approach for stance-control orthoses. *IEEE Transactions on Neural Systems and Rehabilitation Engineering* 2009;17(5):497-503.
- Yakimovich T, Lemaire ED, Kofman J. Preliminary kinematic evaluation of a new stance-control knee-ankle-foot orthosis. *Clinical Biomechanics* 2006;21:1081-1089.
- Haché G, Lemaire ED, Baddour N. Development of a wearable mobility monitoring system. Proceedings of the 32nd Canadian Medical and Biological Engineering Conference. Calgary, May 2009.

DYNAMIC STABILITY IN PEOPLE WITH LOWER LIMB AMPUTATIONS

(Funded by The Ottawa Hospital Centre for Patient Safety)

An improved understanding of factors related to dynamic stability in lower-limb prosthesis users is important, given the high occurrence of falls in this population. To study stability for people with unilateral transtibial amputations, 20 community ambulators walked over level ground, uneven ground, stairs, and a ramp while in-shoe pressure data were collected. For each limb (intact and prosthetic) and condition, six stability parameters related to plantar center-of-pressure perturbations and gait temporal parameters were computed from the plantar pressure data. Parameter values were compared between limbs, walking condition, and groups (unilateral transtibial prosthesis users and able-bodied subjects). Differences in parameters were found between limbs and conditions, and between prosthesis users and able-bodied individuals. Interestingly, the intact limb is more unstable during most activities, likely since prosthesis users optimize time on the prosthesis for safety/stability and accommodate for any variations when the intact limb is on the ground. Stair walking produced the most unstable condition. Further research could investigate alternative anterior/posterior and medial/lateral parameter thresholds for unilateral transtibial prosthesis users and define relationships between potential for falls and the dynamic stability measures.

GRADUATE STUDENTS

UNIVERSITY OF OTTAWA

Biomedical Engineering (MAsc)

Victor Liang

Gaëtanne Haché

Mechanical Engineering (MAsc)

Hui-Hsien Wu

Human Kinetics (MSc)

Sean Doyle

Shannon Becker

Cynthia Kendell

Population Health (PhD)

Janet Young

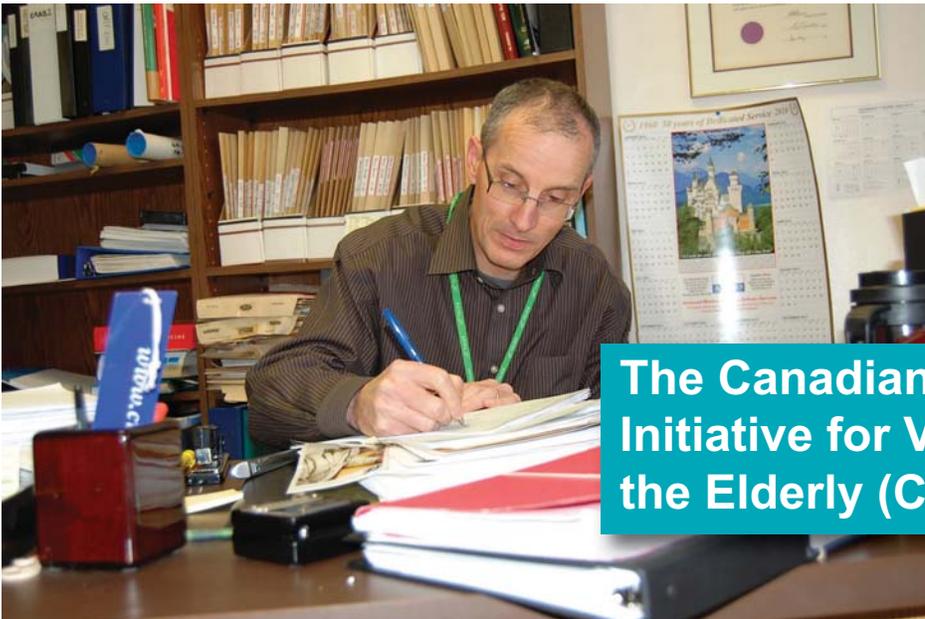
UNIVERSITY OF WATERLOO

Systems Design Engineering (MAsc)

Alex Spring

Taresh Mistry

Sean Sullivan



The Canadian Driving Research Initiative for Vehicular Safety in the Elderly (Candrive II)

CO-PRINCIPAL INVESTIGATORS: Shawn Marshall and Malcolm Man-Son-Hing

Coinvestigators: MICHEL BÉDARD, Lakehead University; PAUL BOASE, Transport Canada; ANNA BYSZEWSKI, University of Ottawa; ANN CRANNEY, University of Ottawa; HILLEL FINESTONE, University of Ottawa; SYLVAIN GAGNON, University of Ottawa; ISABELLE GÉLINAS, McGill University; MICHEL JOHNSON, Lakehead University; NICOLE KORNER-BITENSKY, McGill University; LINDA LI, University of British Columbia; BARBARA MAZER, McGill University; FRANK MOLNAR, University of Ottawa; JEANETTE MONUFAUR, University of Manitoba; ANITA MYERS, University of Waterloo; GARY NAGILE, University of Toronto; JANICE MILLAR POLGAR, University of Western Ontario; MICHELLE PORTER, University of Manitoba; MARK RAPOPORT, University of Toronto; IAN STIELL, University of Ottawa; HOLLY TUOKKO, University of Victoria; BRENDA VRKLJAN, McMaster University; GEORGE WELLS, University of Ottawa

The Canadian Driving Research Initiative for Vehicular Safety in the Elderly (Candrive) is a network of diverse Canadian researchers. Established in 2002, as a result of funding from a Canadian Institutes of Health Research (CIHR) NET grant, the program is aimed at improving the safety and quality of life of older drivers. Members of the research team include occupational therapists, physiotherapists, psychologists, kinesiologists, epidemiologists, and a number of medical specialists in geriatric medicine, physical medicine and rehabilitation, rheumatology and geriatric psychiatry. In addition, collaboration with key stakeholders including seniors' organizations, provincial ministries of transportation and professional organizations is imperative in ensuring that Candrive research translates into improved older driver public policy and clinical practice.

Currently, the Candrive team is conducting a multi-centre study entitled "Candrive Common Cohort and the Development of an Evidence-Based Driving Decision Rule for Identifying Older Drivers at Increased Risk for At-fault Crashes". Study investigators propose to recruit 1000 older drivers, aged 70 and up, from seven Canadian cities. The primary objective is to develop an evidence-based tool for health-care professionals that will help identify drivers who are at increased risk for at-fault motor vehicle collisions. In June 2009, investigators began recruiting study participants

in Victoria, Winnipeg, Thunder Bay, Toronto, Hamilton, Ottawa and Montreal. As of March 2010, over 600 recruits have been enrolled. Study participants must undergo an annual assessment that includes a set of physical, behavioural and cognitive tests. Installation of in-vehicle Global Positioning System (GPS) devices occurs at the first assessment to monitor driving patterns, such as speed, distance, length of time driving, and the effect of climate conditions on driving. In addition to the annual assessment, follow-up assessments occur at 4 and 8 months throughout the five year period. Participants will also be followed for any crashes (as determined by self-report and Ministry of Transportation databases), traffic violations, and driving cessation.

This study has recently obtained international acclaim. Candrive has recently announced its partnership with researchers from Monash University in Melbourne, Australia. The Australian researchers have been awarded a \$1.8m, five-year Australian Research Council Linkage grant (Managing older driver safe mobility: An international collaboration). The study will include a Melbourne and a New Zealand site and researchers plan to enroll 250 study participants. Additionally, colleagues from the University of Michigan are exploring the possibility of establishing a US site for the study.

Funded by the Canadian Institutes of Health Research

SELECTED PUBLICATIONS

Bedard M, Porter MM, Marshall SC, Isherwood I, Riendeau J, Weaver B, Tuokko H, Molnar F, Miller-Polgar J. The combination of two training approaches to improve older adults' driving safety. *Traffic Injury Prevention* 2008;9:70-76.

Cyr A, Yamin S, Belanger A, Hing M, Marshall S, Gagnon S. Effect of old age on dual task performance during driving simulations of varying complexities. *Advances in Transportation Studies* 2006;Special Issue:31-44.

Cyr AA, Stinchcombe A, Gagnon S, Marshall SC, Man-Son-Hing M, Finestone H. Driving difficulties of brain injured drivers in reaction to high crash risk simulated road events: a question of impaired divided attention? *Journal of Clinical and Experimental Neuropsychology* 2009;31(9):472-482.

Jang RW, Man-Son-Hing M, Molnar FJ, Hogan DB, Marshall SC, Auger J, Graham ID, Korner-Bitensky N, Tomlinson G, Naglie G. Family physicians' attitudes and practices regarding assessments of medical fitness to drive in older persons. *Journal of General Internal Medicine* 2007;22:531-543.

Kua I, Korner-Bitensky N, Desrosiers J, Man-Son-Hing M, Marshall S. Older driver retraining: A systematic review of evidence of effectiveness. *Journal of Safety Research* 2007;38:81-90.

Malcolm Man-Son-Hing MD, Shawn C Marshall MD, Frank J Molnar MD, Keith G. Wilson PhD. Systematic review of driving risk and the efficacy of compensatory strategies in persons with dementia. *Journal of the American Geriatrics Society* 2007;55:878-884.

Marshall SC. The role of reduced fitness to drive due to medical impairments in explaining crashes involving older drivers. *Traffic Injury Prevention* 2008;9:291-298.

Marshall Shawn. Determining medical fitness to drive: Physicians need support. *Open Medicine* 2008;2(1):E18-19.

Marshall S, Man-Son-Hing M, Molnar F, Wilson KG, Blair R. The acceptability to older drivers of different types of licensing restriction. *Accident Analysis and Prevention* 2007;39:776-793.

Marshall SC, Molnar FJ, Man-Son-Hing M, Wilson KG, Stiell I, Porter MM. Measurement of driving patterns of older adults using data logging devices with and without global positioning system capability. *Traffic Injury Prevention* 2007;8:260-266.

Molnar FJ, Marshall SC, Man-Son-Hing M, Wilson KG, Byszewski AM, Stiell I. Acceptability and concurrent validity of measures to predict older driver involvement in motor vehicle crashes: An Emergency Department pilot case-control study. *Accident Analysis and Prevention* 2007;39:1056-1063.

Rapoport MJ, Herrmann N, Molnar FJ, Man-Son-Hing M, Marshall SC, Shulman K, Naglie G. Sharing the responsibility for assessing the risk of the driver with dementia. *CMAJ* 2007;177(6):599-601.

ONGOING RESEARCH

- Driving Patterns of Older Canadians
- Influence of Psychological Factors on Driver Decision-Making and Behaviour
- Advancements in Automotive Design: Development of a Vehicle Design Rating System (VDRS) that Links Older Drivers' Abilities and Automotive Features
- Assessing the Relevance of the Simulator as a Screening Tool for At-Risk Older Drivers
- Driver Improvement



Canadian National Palliative Care Survey

PRINCIPAL INVESTIGATOR: Keith Wilson

Coinvestigators: PIERRE ALLARD, University of Ottawa; SUSAN BRAJTMAN, University of Ottawa; HARVEY M CHOCHINOV, University of Manitoba; SRINI CHARY, University of Saskatchewan; JENNIFER J CLINCH, Ottawa Hospital Research Institute; MARINA DE LUCA, British Columbia Cancer Agency; ROBIN L. FAINSINGER, University of Alberta; PIERRE R GAGNON, Université Laval; MERIKA GRAHAM SKIRKO, Ottawa Hospital Research Institute; ANDREA M KARAM, Ottawa Hospital Research Institute; DAVID KUHL, University of British Columbia; KATERINE LEMAY, University of Ottawa; MICHELLE M LOBCHUK, University of Manitoba; KAREN MACMILLAN, Grey Nuns Community Hospital; CHRISTINE J MCPHERSON, University of Ottawa; MARY ANN MURRAY, University of Ottawa; FIONA O'SHEA, Dr. H Bliss Murphy Cancer Centre

In the mid-1990s, a committee of the Canadian Senate held public hearings into the question, "Should we follow the lead of The Netherlands and legalize euthanasia and physician-assisted suicide?" In their final report, the committee came out against legalization, partly because of the sweeping ethical ramifications, but also because there was very little data to inform the public as to how often these practices would be performed, with what kind of patients, and the reasons underlying patient requests for death-hastening acts. The committee recommended that research be undertaken to address these issues.

Around the same time, our research group was beginning to develop an interest in palliative care, and we had actually conducted one of the first studies on the "desire for death in the terminally ill" (Chochinov, Wilson, Enns, Mowchun, Lander, Levitt, and Clinch, 1995), an article that has been cited over 400 times in the medical literature. We found that there was a clear link between mental health issues and the desire to die in patients with advanced cancer. The desire for death, however, is not necessarily the same thing as the desire for euthanasia. For example, there may be some people who are ready for death to come, but would never request euthanasia because of moral objection. Then again, there may be some people who do not want to die, but would request euthanasia anyway because they have no option to continue living when they have such advanced disease.

We needed a large, national study that asked terminally ill patients very directly about euthanasia and assisted suicide. We called it the Canadian National Palliative Care Survey (NPCS).

The NPCS was a multi-centre study of quality of life among people who were receiving palliative care for cancer, with centres in Newfoundland, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, and British Columbia. It was based at the Ottawa Hospital Research Institute, with Keith Wilson as the principal investigator. A study of this scale was rather unprecedented in the palliative care literature, so we took the opportunity to ask a number of important questions about quality of life, beyond the issue of euthanasia.

A defining feature of the NPCS was its use of a "multi-methods" approach, combining quantitative statistics with in-depth qualitative analyses of patients' narrative responses to open-ended questions. Several important articles have been published as a result of this research.

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SELECTED PUBLICATIONS

Lemay K, Wilson KG. Treatment of existential distress in life-threatening illness: A review of manualized interventions. *Clinical Psychology Review* 2008;28:472-493.

Thompson GN, Chochinov HM, Wilson KG, McPherson CJ, Chary S, O'Shea F, Kuhl D, Fainsinger RL, Gagnon PR, Macmillan K. Prognostic acceptance and the well-being of patients receiving palliative care for cancer. *Journal of Clinical Oncology* 2009;27:5757-5762.

Wilson KG, Chochinov HM, Allard P, Chary S, Gagnon PR, Macmillan K, De Luca M, O'Shea F, Kuhl D, Fainsinger RL. Prevalence and correlates of pain in the Canadian National Palliative Care Survey. *Pain Research and Management* 2009;14:365-370.

Wilson KG, Chochinov HM, Graham M, Allard P, Chary S, Gagnon PR, Macmillan K, De Luca M, O'Shea F, Kuhl D, Fainsinger RL, Clinch JJ. Depression and anxiety disorders in palliative cancer care. *Journal of Pain and Symptom Management* 2007;33:118-129.

Wilson KG, Chochinov HM, McPherson CJ, LeMay K, Allard P, Chary S, Gagnon PR, Macmillan K, De Luca M, O'Shea F, Kuhl D, Fainsinger RL. Suffering with advanced cancer. *Journal of Clinical Oncology* 2007;25:1691-1697 [published with an accompanying editorial, *Journal of Clinical Oncology*;25:1645-1646].

Wilson KG, Chochinov HM, McPherson CJ, Graham M, Allard P, Chary S, Gagnon PR, Macmillan K, De Luca M, O'Shea F, Kuhl D, Fainsinger RL, Karam AM, Clinch JJ. Desire for euthanasia or physician-assisted suicide in palliative cancer care. *Health Psychology* 2007;26:314-323.

TRAINEES

Patricia Poulin, Post-doctoral trainee
Ottawa Hospital Cancer Centre
Mindful body awareness versus hypervigilance in chronic pain

Cheryl Harris, Psychologist in supervised practice
Ottawa Hospital Cancer Centre
Cognitive-behavioural treatment of insomnia in breast cancer survivors with or without chronic pain

UNDERGRADUATE STUDENTS

Livia Cyurlia, BA Honours Psychology
University of Ottawa
Self-perceived burden among stroke patients and their spouses

Celia Geck, BA Honours Psychology
University of Ottawa
Who gets worse after participation in a multidisciplinary program for the treatment of chronic pain?

GRADUATE STUDENTS

Katerine LeMay, PhD Psychology
University of Ottawa
Fear of pain among patients with chronic cancer and non-cancer pain

Fontini Zachariades, PhD Psychology
Fielding University
Self-help treatment for insomnia in chronic pain

Brahm Solomon, PhD Psychology
University of Ottawa
Fear of breathlessness in chronic obstructive pulmonary disease

ONGOING RESEARCH

- Depression and the Desire for Death in the Terminally Ill
- Panic Attacks in Palliative Care
- Patient Satisfaction with Palliative Care
- Coping with Chronic Neuropathic Pain in Cancer Survivors



Clinical and Evaluative Research in Chronic Pain Rehabilitation

PRINCIPAL INVESTIGATOR: John Kowal

Coinvestigators: KEITH WILSON, The Ottawa Hospital Rehabilitation Centre; LACHLAN MCWILLIAMS, Acadia University, BRUCE DICK, University of Alberta; PETER HENDERSON, The Ottawa Hospital Rehabilitation Centre; DEAN FERGUSON, The Ottawa Hospital Research Institute; GRIFFITH MERCER, The Ottawa Hospital Rehabilitation Centre

Chronic pain is a complex health condition with numerous psychological, interpersonal, public health and financial costs. It is estimated that between 11% and 29% of Canadian adults live with chronic pain, and that the economic burden of chronic pain in Canada is somewhere in the neighbourhood of \$10 billion annually. Effectively treating individuals living with chronic pain is therefore an important health-care and public health priority.

At the Ottawa Hospital Rehabilitation Centre (TOHRC), individuals with chronic pain have received rehabilitation services since the early 1980s. The goals of the Chronic Pain Management Program (CPMP) are to: 1) provide education about chronic pain and disability management; 2) increase activity level and help people remain active even though they continue to live with pain; 3) improve physical fitness levels; and 4) improve emotional functioning.

Several program evaluations of the chronic pain rehabilitation services have been conducted since the early 1990s, all of which demonstrated the clinical effectiveness of treatment. Preliminary findings of the most recent evaluation are encouraging and suggest that the current program effects numerous positive treatment gains, including improved mood, self-efficacy, adaptive coping, and physical fitness, as well as decreased pain-related fear and maladaptive coping.

Building on this tradition, the goal of the present research was to develop a comprehensive program of study examining psychosocial factors involved in chronic pain.

Specifically, the proposed research program aimed to examine association between interpersonal variables (e.g., adult attachment styles), psychological variables (e.g., pain-related thoughts and feelings, coping, overall symptoms and distress) and program outcomes (e.g., change in mood, level of disability, and health-care utilization).

In addition, this research is the first to examine the concepts of self-perceived burden (i.e., feeling like a burden to others) and demoralization in patients with chronic pain. Results will be used to further refine and develop the current Chronic Pain Management Program at TOHRC by better tailoring the program to the unique needs of patients. It will also shed light on key variables associated with patients' experiences living with chronic pain.

Consistent with standard clinical care, the data will be discussed with patients at various points during the program and used to evaluate treatment progress over time. Preliminary data have been submitted for presentation at the 2010 Annual Meeting of the Canadian Psychological Association in Winnipeg, Manitoba and the 2010 World Congress on Pain, Montreal, Quebec.

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SELECTED PUBLICATIONS

McPherson CJ, Wilson KG, Murray MA. Feeling like a burden to others: Systematic review focusing on the end of life. *Palliative Medicine* 2007;21:115-128.

Meredith PJ, Ownsworth T, Strong J. A review of the evidence linking adult attachment theory and chronic pain: Presenting a conceptual model. *Clinical Psychology Review* 2008;28:407-429.

Mikail SF, Henderson PR, Tasca GA. An interpersonally based model of chronic pain: An application of attachment theory. *Clinical Psychology Review* 1994;14:1-16.

RESEARCH ASSISTANTS

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RESIDENTS

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FIRST POST DOCTORAL FELLOW IN REHABILITATION PSYCHOLOGY INVESTIGATES MINDFULNESS-BASED INTERVENTIONS IN THE TREATMENT OF CHRONIC PAIN

Dr. Patricia Poulin joined the Psychology Department of TOHRC in October 2009 for a post-doctoral fellowship in Rehabilitation Psychology. Under the supervision of Dr. Keith Wilson, Dr. Poulin has developed a program of research focusing on mindfulness. She is currently working with Dr. Wilson and Dr. Nathan (anaesthesiologist at the TOH Pain Clinic) on a systematic review of the empirical literature focusing on the efficacy of mindfulness-based interventions in the treatment of chronic pain. In collaboration with several clinicians and researchers from TRC and the TOH Pain Clinic, she is conducting a cross-sectional study to examine the role of body-awareness (a component of mindfulness) on functional disability in chronic pain.

This study will provide research and clinical data that will allow the interdisciplinary research team to conduct a comparative study of patients who are referred to the TOH Pain Clinic and the TOHRC Chronic Pain Management Program on several outcomes, allowing for a better understanding of these two patient populations. Dr. Poulin is also conducting an exploratory study of the effect of body awareness training in chronic pain at the TOH Feldenkrais Clinic, in collaboration with Christine Graves, OT.

For her clinical practice in preparation for her registration with the College of Psychologists of Ontario, Dr. Poulin has been seeing patients who are referred to outpatient Psychology services at TOHRC under the supervision of Dr. Erik Petersen, C.Psych., as well as patients from the TOH Gynecology-Oncology services, under the supervision of Dr. Monique Lefebvre, C.Psych.



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