

# **Centre for Research on Safe Driving (CRSD)**

## **Progress Report (2009 to 2012)**

Prepared by

Michel Bédard, PhD

Director

December 5, 2012

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# **1 A brief historical background of the centre**

## ***1.1 Formal development of the centre***

The Centre for Research on Safe Driving (CRSD) was originally developed as the Interdisciplinary Program for Research on Safe Driving. In December 2008 the formation of the CRSD was officially approved by the Lakehead University Senate. This decision was ratified by the Lakehead University Board of Governors in February 2009.

## ***1.2 Statement of the problem (from the original proposal)***

Traffic-related collisions represent a considerable health and economic burden on our society. In any one year in Canada, there are approximately 150,000 collisions resulting in personal injuries, and 2,500 collisions resulting in fatalities (Transport Canada, 2006). In Northern Ontario, the statistics paint an even more worrisome picture, especially for older age groups. Whereas the number of collisions requiring hospitalizations in drivers age 70-79 is 43.7 per 100,000 in Ontario, it is 77.1 for Northern Ontario. Similarly, for the drivers aged 80 and over, these numbers are respectively 45.9 and 75.4. These numbers represent more than 50% excess in collisions requiring hospitalizations in the North compared to the rest of the Province. Furthermore, if recent predictions are correct, the number of crashes and fatalities in older adults will increase substantially in coming years (Bédard, Stones, Guyatt, & Hirdes, 2001).

For the most part, collisions are preventable, irrespective of the driver's age. This is aptly illustrated by the steady decline in collisions, injuries, and fatalities over recent years. However, most of that decline is really the result of limited driving (exposure) in younger drivers; much remains to be done to reduce the number and severity of crashes without relying on driving restrictions. Restricting driving should not be the preferred approach for older drivers. Our goal should be first to maximize safe driving not to restrict or remove the driving privilege. Hence, the philosophical underpinning of our Centre is to support safe driving throughout the lifespan not to take away driving privileges. We firmly believe that through an enhanced understanding of the basic mechanisms that support safe driving we can contribute to the development of initiatives to further this goal.

## ***1.3 Mandate***

Our mandate is to contribute to the reduction of traffic-related injuries by carrying out basic and applied research on processes that support safe driving, and developing interventions that promote road safety.

### **1.3.1 Goals**

- Foster interdisciplinary collaboration towards safe driving.
- Provide a nurturing environment for students to support the development of the next generation of researchers (junior faculty, graduate and undergraduate students).
- Contribute to the body of knowledge regarding safe driving.
- Support initiatives to reduce traffic-related crashes.
- Develop a reputation for high-quality research at the provincial, national, and international levels.

### **1.3.2 Objectives**

- Increase the number and quality of grant applications submitted to tri-council funding agencies and other granting bodies.
- Increase the involvement of other faculty and community partners in the research.
- Increase the number of research projects related to safe driving.
- Increase the output and dissemination of research knowledge produced by members of the Centre.

### **1.3.3 The university mandate and the region**

The centre was highly relevant to the university mandate at the time of inception and continues to this day. Specifically, the current Academic/Strategic Research Plan includes six priority areas, three of which are primarily relevant to this proposal: 1) “Cultures, Societies, and Social Justice”, 2) “First Nation, Metis and Inuit (Aboriginal) Research”, and 3) “Health Research Across the Life Span”. “Cultures, Societies, and Social justice” is relevant because our attitudes towards prevention can be shaped by societal attributes. For example, for some cultures crashes may be perceived as the result of “fate”, something which cannot be prevented. Hence, to change driver behavior we need to recognize the heterogeneity of drivers as our society becomes multi-cultural. Policy is also frequently the result of societal pressures. For example, older drivers are the focus of much attention by policy makers despite an overall safety record better than that of young drivers. Furthermore, this increased scrutiny often appears motivated by financial gain. This exemplifies the need for scientifically valid information and effective knowledge translation to support sound policy-making. Members of the Centre for Research on Safe Driving (CRSD) already have an important track record about this issue.

Aboriginal research is also crucial because Aboriginal groups typically have worse crash statistics and survival rates than other ethnic groups. This is not meant to be negative but rather to highlight the structural inequities creating this situation and promote the

development of a research agenda to identify the opportunities that would lead to road safety improvements among the Aboriginal population and support efforts towards Social Justice. Members of the CRSD have recently received funding to develop a research agenda in this regard and have outlined this research agenda in a manuscript submitted for publication in the Canadian Journal of Public Health. We hope to engage in further work in this area.

Finally, relevance to the third priority area is self-evident. As mentioned earlier, the social and economic costs of crashes are staggering, especially in light of the potential for prevention. The “lifespan” component is also important as the risk of involvement in crashes and the reasons for such involvement change over time. The potential to survive crash-related trauma also varies with age, and the benefits derived from driving an automobile evolve through life. Ultimately, this illustrates once again that drivers do not represent a homogeneous group, but rather a collection of vastly different individuals for whom injury prevention should be a primary research focus.

The CRSD’s activities are also aligned with the Faculty of Health and Behavioural Sciences’ strategic plan, particularly regarding the direction to “strengthen research capacity and synergy”. There are three goals to this direction: 1) build research capacity, 2) increase research productivity, and 3) increase research funding successes. The CRSD enhances the efforts of other Lakehead University researchers and contribute to greater research capacity, productivity, and funding support. Also of relevance is the proposed Faculty initiative to “promote external dialogue about research (e.g., interests, activities, opportunities) to ensure relevance to communities”. The proposed area of focus offers responsiveness to the need of individuals and communities and to that of policy-makers.

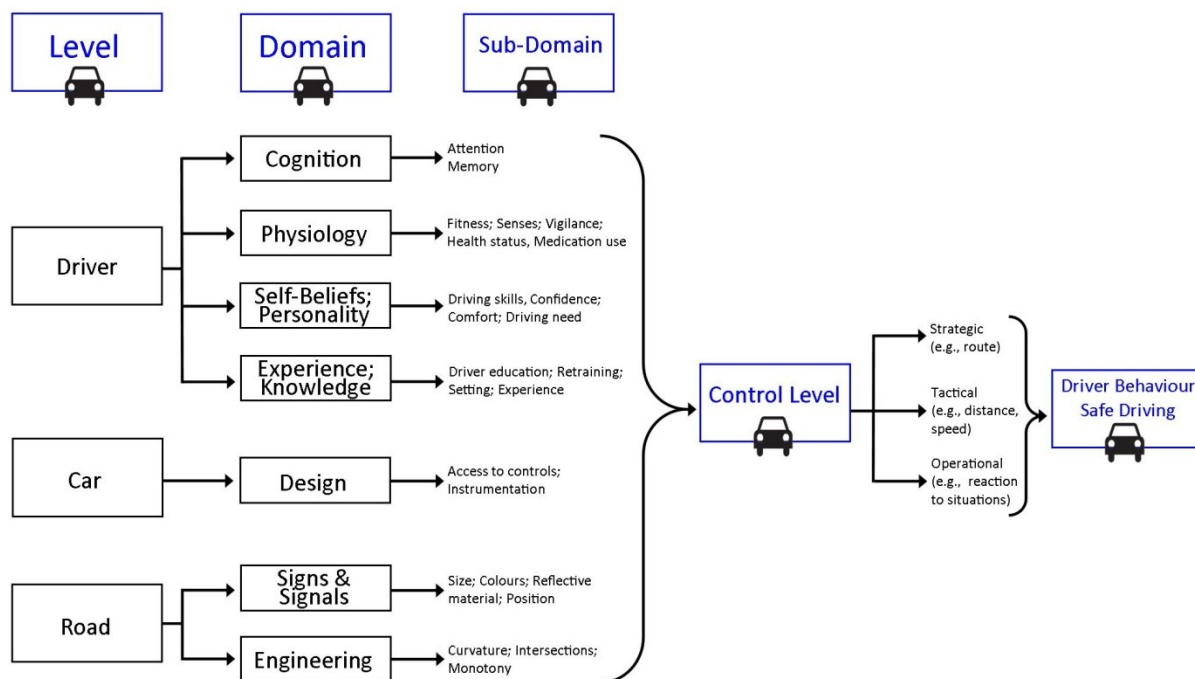
To further this responsiveness and also ensure the relevance of the CRSD’s research agendas it is expected that we will continue to foster interactions between basic and applied researchers from various disciplines “to create emerging opportunities that are multidisciplinary, interdisciplinary, and/or interprofessional in nature...” (Academic/Strategic Research Plan, p. 9). These interactions form the basis of new collaborations and innovative research, ultimately resulting in greater research capacity, funding, output, and knowledge translation.

#### ***1.4 The theoretical framework***

Driving is a complex task that is supported by various systems (Eby, Molnar, Shope, Vivoda, & Fordyce, 2003). To successfully understand safe driving we use a model that lends itself to empirical testing (from Michon; see Figure next page). We start with the accepted notion that to successfully support safe driving we can intervene on three different general levels: 1) the driver, 2) the car, and 3) the driving environment (road) (Wang & Carr, 2004).

These levels can be decomposed into domains and sub-domains. For example, “cognition” is a domain within the “driver” level, and is composed of several sub-domains such as “attention” and “memory”. All sub-domains are intricately linked to one or more of the three “control” levels proposed by Michon (Michon, 1979). The control levels are: 1) strategic, 2) tactical, and 3) operational. Decisions regarding the driving plan (e.g., route) are made at the strategic level. Decisions relevant to vehicle handling (e.g., speed) are made at the tactical level. Finally, the operational level includes actual driving actions that may have a direct impact on crashes (e.g., braking, steering). These three control levels then mediate driver behaviour and safe driving.

Figure



## 2 Statement describing how the Centre or Research Institute has achieved or revised the original objectives

The original research objectives encompassed four themes: two at the driver level, and one each at the car and road levels. At the driver level we proposed to concentrate on the contributions of attention and physiology to safe driving. At the car level we proposed to concentrate on suitability of instrumentation and controls to maximize safe driving. At the road level we proposed to examine the contribution of road design towards safe driving. A fifth theme that was not proposed originally but became essential was the validation of our driving

simulator. Several projects were completed and other currently underway to fully assess the validity of the simulator and extend its capacity as a research and assessment tool. The five themes are all linked to safe driving and entail the development of a body of fundamental knowledge to guide future research.

### ***2.1 Theme 1: Attention systems***

The first theme was developed to provide further knowledge on the contribution of attention systems to driving. We successfully demonstrated that measures of attention efficiency are related to simulated driving performance (Weaver et al., 2009). This led to the development of a new computer-based tool to measure attention capacity (Weaver et al., submitted) and the demonstration that this measure is less biased by age and education status than measures of attention currently used for assessment of older drivers (Bédard et al., in preparation). We also conducted work to demonstrate that current protocols to assess fitness-to-drive based on cognitive measures lack sufficient sensitivity and specificity to be adopted at present (Bédard et al., 2011a; 2011b; submitted; Hogan & Bédard, 2011). An extension of this work has been the demonstration of poor congruence between self-reported fitness-to-drive and actual abilities (Riendeau et al., submitted).

### ***2.2 Theme 2: The contribution of physiology***

The second theme was developed to enhance our understanding of the contribution of physiological status (e.g., blood pressure regulation) to safe driving. This was meant to replicate earlier work showing a relationship between blood pressure and performance on attention tasks related to fitness-to-drive. We now have data on several hundred participants, using various measures related to safe driving (including simulated driving) and will be examining these data in the near future (this would be a great Master's project). The physiological theme was further expanded to increase our knowledge of the effect of medications on driving performance. Our work further confirmed the potential negative impact of benzodiazepines (Maxwell et al., 2010), stimulants (Gates et al., submitted) and narcotics (Dubois et al., 2010; Regulý et al., submitted).

### ***2.3 Theme 3: Vehicle characteristics***

Theme three is an examination of the contribution of in-car instrumentation and controls to safe driving. Contrary to our hypothesis our research did not demonstrate a negative impact on safety when participants were required to follow simulated GPS instructions. However, participants clearly spent more time looking away from the roadway when using a dashboard-mounted GPS than a windshield display or auditory instructions (Morrison et al., 2010). An important contribution to this theme was the critical examination of 15-passenger vans crash



data (Potter et al., accepted). This analysis revealed important considerations in deciding on the safest mode of transportation for small groups.

## **2.4 Theme 4: Road engineering**

The fourth theme was developed to understand the interaction of road engineering design with automotive systems on safe driving. Our primary focus has been on the development of a simulator model for lane departure warnings. Specifically, we programmed warning systems in the simulator to inform drivers that they are approaching the centerline or road edge. Our results indicated fewer encroachments into the left lane and road shoulder, and an overall reduction in lane deviations (Mullen et al., 2010).

## **2.5 Theme 5: Simulator technology**

The fifth theme was focused on simulator technology. Our first task was to validate simulated driving vis-à-vis on-road driving, determine that the “play-back” technology could be used reliably to assess driving at a later time, and that two different evaluators could return similar assessments (Bédard et al., 2010). We also used our experience with physiological recordings to demonstrate that the physiological demands placed on drivers during a simulated drive are correlated to those experienced on the road and that drivers are immersed in the simulated condition (Johnson et al., 2011). Because some participants may experience a form of car sickness in the simulated environment we verified that such feelings are independent of performance (Mullen et al., 2010). Furthermore, we have developed a full protocol to assess the impact of medications using various tests of cognition and simulated driving. This will allow the extension of our work on medications using robust experimental and double-blinded designs. We also contributed a book chapter (Mullen et al., 2011) on simulator validity in what is considered the most authoritative work on driving simulation (Fisher et al, Eds., *Handbook of driving simulation for engineering, medicine, and psychology* 2011).

# **3 Detailed list of research accomplishments**

## **3.1 Publications (peer-reviewed; present and past members of the CRSD are in bold letters, trainees are underlined)**

**Bédard M, Parkkari M, Weaver B, Riendeau J, Dahlquist M.** Assessment of driving performance using a simulator protocol: Validity and reproducibility. *American Journal of Occupational Therapy* 2010; 64: 336–340.

**Bédard M, Riendeau J, Weaver B, Clarkson A.** Roadwise Review has limited congruence with actual driving performance of aging drivers. *Accident Analysis & Prevention* 2011; 43:2209-2214.

**Bédard M, Weaver B.** Commentary on: Cognitive training for older drivers can reduce the frequency of involvement in motor vehicle collisions. *Evidence-based Mental Health* 2011; 14:52. (Invited)

**Bédard M, Weaver B, Man-Son-Hing M, Classen S, Porter MM, Byszewski A, Charlton J, Gagnon S, Gélinas I, Korner-Bitensky N, Langford J, Marshall S, Myers A, Rapoport M, Tuokko H, Vrkljan B.** The SIMARD screening tool to identify unfit drivers: Are we there NOW? *Journal of Primary Care and Community Health* 2011; 2:133-135.

Classen S, Wang Y, Winter SM, Velozo CA, Lanford DN, **Bédard M.** Concurrent criterion validity of the Safe Driving Behavior Measure: A predictor of on-road driving outcomes. *American Journal of Occupational Therapy* (accepted).

Classen S, Wen P-S, Velozo CA, **Bédard M, Winter SM, Brumback B, Lanford DN.** Psychometrics of the self-report Safe Driving Behavior Measure for older adults. *American Journal of Occupational Therapy* 2012; 66:233-241.

Classen S, Wen P-S, Velozo CA, **Bédard M, Brumback B, Winter SM, Lanford DN.** Rater reliability and rater effects of the Safe Driving Behavior Measure. *American Journal of Occupational Therapy* 2012; 66:69-77.

Classen S, Winter SM, Velozo C, **Bédard M, Lanford D, Brumback B, Lutz B.** Item development and validity testing for a Safe Driving Behavior Measure. *American Journal of Occupational Therapy* 2010; 64: 296–305.

Crizzle AM, Classen S, **Bédard M, Lanford D, Winter S.** MMSE as a predictor of on-road driving performance in community dwelling older drivers. *Accident Analysis & Prevention* (accepted).

Därziņš P, **Bédard M.** Older road users – Effects of dementia and cognitive changes. In Odell M (Ed.). *Older Road Users: Myths and Realities, A Guide for Medical and Legal Professionals.* 2009. Lawyers and Judges Publishing Company.

**Dubois S, Bédard M, Weaver B.** The impact of opioid analgesics on safe driving. *Accident Analysis & Prevention* 2010; 42: 30-37.

Hogan DB, **Bédard M.** Review of the introduction of a new screening tool for the identification of cognitively impaired medically at-risk drivers. *Canadian Geriatrics Journal* 2011; 14:51-54.

**Johnson MJ, Chahal T, Stinchcombe A, Mullen N, Weaver B, Bédard M.** Physiological responses to simulated and on-road driving. *International Journal of Psychophysiology* 2011; 81:203-8.

**Lambert-Bélanger A, Dubois S, Weaver B, Mullen N, Bédard M.** Aggressive driving behaviour in young drivers (aged 16 through 25) involved in fatal crashes. *Journal of Safety Research* 2012; 43:333-338.

**Maxwell H, Dubois S, Weaver B, Bédard M.** The additive effects of alcohol and benzodiazepines on driving. *Canadian Journal of Public Health* 2010; 101:353-357.

**Morrison L, Weaver B, Mullen N, Bédard M.** Using visual driving instructions to resemble a GPS on a simulated driving course. *Advances in Transportation Studies Special Issue* 2010; 89-98.

**Mullen N, Bédard M.** The end of driving. In Odell M (Ed.). *Older Road Users: Myths and Realities, A Guide for Medical and Legal Professionals*. 2009. Lawyers and Judges Publishing Company.

**Mullen N, Bédard M, Riendeau JA, Rosenthal TJ.** Simulated lane departure warning system reduces the width of lane that drivers use. *Advances in Transportation Studies Special Issue* 2010; 33-44.

**Mullen N, Charlton J, Devlin A, Bédard M.** Simulator validity: Behaviors observed on the simulator and on the road. In D. L. Fisher, M. Rizzo, J. Caird, & J. D. Lee (Eds.), *Handbook of driving simulation for engineering, medicine, and psychology* 2011. (Book chapter)

**Mullen N, Chattha HK, Weaver B, Bédard M.** Older driver performance on a simulator: Associations between simulated tasks and cognition. *Advances in Transportation Studies Special Issue* 2008; 31-42.

**Mullen N, Weaver B, Riendeau J, Diamond L, Bédard M.** Driving performance and susceptibility to simulator sickness: Are they related? *American Journal of Occupational Therapy* 2010; 64: 288–295.

Rapoport MJ, Lanctot K, Streiner D, **Bédard M**, Vingilis E, Murray B, Schaffer A, Shulman K, Herrmann N. Benzodiazepines and driving: A meta-analysis. *Journal of Clinical Psychiatry* 2009; 70:663-673.

Rapoport MJ, **Weaver B**, Kiss A, Sarracini CZ, Moller H, Herrmann N, Lanctôt K, Murray B, **Bédard M.** The effects of donepezil on computer-simulated driving ability among healthy older adults: A pilot study. *Journal of Clinical Psychopharmacology* 2011; 31:587-92.

Stinchcombe A, Gagnon S, Zhang JJ, Montembeault P, **Bédard M.** Fluctuating attentional demand in a simulated driving assessment: The roles of age and driving complexity. *Traffic Injury Prevention* 2011; 12:576-87.

**Weaver B, Bédard M, McAuliffe J, Parkkari M.** Using the Attention Network Test to predict driving test scores. *Accident Analysis & Prevention* 2009; 41:76-83.

Winter SM, Classen S, **Bédard** M, Lutz BJ, Velozo CA, Lanford DN, Brumback BA. Focus group findings for the self-report Safe Driving Behaviour Measure. Canadian Journal of Occupational Therapy 2011; 78:72-79.

### **3.2 Publications (submitted for peer-review)**

**Bédard** M, Marshall S, Man-Son-Hing M, **Weaver** B, Gélinas I, Korner-Bitensky N, Mazer B, Naglie G, Porter MM, Rapoport MJ, Tuokko H, Vrkljan B. It is premature to test aging drivers with the SIMARD-MD.

Classen S, Wang Y, Winter SM, Velozo CA, Lanford DN, **Bédard** M. Using the Safe Driving Behavior Measure to predict on-road outcomes in older drivers and their family members/caregivers.

Gates J, Dubois S, Mullen N, **Weaver** B, **Bédard** M. The influence of stimulants on truck Driver crash responsibility in fatal crashes.

Mullen N, Dubois S, **Bédard** M. Observed, estimated, and projected fatality trends for younger, middle-aged, and older drivers and passengers.

Mullen N, Parker B, Wiersma E, **Bédard** M. The impacts of stopping driving: Prospective and retrospective views.

**Potter** T, **Dubois** S, Haras K, **Bédard** M. 15-Passenger Vans and Other Transportation Options: A Comparison of Driver, Vehicle and Crash Characteristics.

Riendeau J, Patterson L, **Bédard** M. Self-rated confidence and on-road driving performance among older adults.

Short MM, **Mushquash** CJ, **Bédard** M. Motor vehicle crashes among Canadian Aboriginal Peoples: Identifying trends, gaps, and priorities in the research literature.

**Weaver** B, **McAuliffe** J, **Bédard** M. Validation of two brief versions of the Attention Network Test.

### **3.3 Presentations (peer-reviewed; present and past members of the CRSD are in bold letters, trainees are underlined)**

**Bédard** M, Man-Son-Hing M, Marshall S, **Weaver**. Educational background may affect performance on tools used to assess fitness-to-drive. Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Riendeau J, Bédard M.** Tools to assess fitness-to-drive: Are we measuring something beyond age-related changes? Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Riendeau J, Bédard M.** Understanding the role of personality in unsafe driver behaviour across the lifespan. Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Mullen N, Ostap S, Bédard M.** Evaluating the DemTect and SIMARD MD as screening tools for older drivers. Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Mullen N, Parker B, Wiersma E, Bédard M.** The impacts of stopping driving: Prospective and retrospective views. Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Morrison L, Weaver B, Bédard M.** Relating Attention Network Test (ANT) measures to cognitive test scores for driver screening in Candrive study spParticipants. Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Marshall S, Man-Son-Hing M, Bédard M.** Candrive: Recruitment and retention strategies for a longitudinal study of Older Canadian drivers. Annual Meeting of the Gerontological Society of America. November 2012, San Diego, CA.

**Bédard M, Man-Son-Hing M, Marshall S, Weaver B.** Data from the Candrive study suggest The “Screen for the Identification of cognitively impaired Medically At-Risk Drivers” has limited value. Aging, Mobility, and Quality of Life conference, June 2012, Ann Arbor, Michigan.

**Bédard M, Man-Son-Hing M, Marshall S, Weaver B.** Application of the “Screen for the identification of cognitively impaired medically at-risk drivers”: Preliminary results from the Candrive cohort. Canadian Multidisciplinary Road Safety Conference, June 2012, Banff, Alberta.

**Dubois S, Maxwell HG, Weaver B, Bédard M.** The impact of some common medications, alone and in combination with alcohol, on crash responsibility. Fifth International Conference on Driver Behaviour and Training, November 2011, Paris, France.

**Gagnon S, Bélanger A, Cary H, Bédard M.** Assessing driving competency in older drivers using a driving simulator: Questioning reliability and external validity. Annual Meeting of the Gerontological Society of America. November 2011, Boston, MA.

**Mullen N, Kafka G, Bédard M.** Preparing for driving cessation: Does health or personality make a difference? Annual Meeting of the Gerontological Society of America. November 2011, Boston, MA.

**Mullen N, Kafka G, Bédard M.** Older driver's driving patterns and satisfaction. Annual Meeting of the Gerontological Society of America. November 2011, Boston, MA.

**Weaver B, Bédard M.** On bridging the gap between theoreticians and practitioners: Types of evidence and knowledge translation. Fifth International Conference on Driver Behaviour and Training, November 2011, Paris, France.

Wang Y, Classen S, Velozo C, Brumback B, **Bédard M**, Winter S, Lanford D. Construct validity of the Safe Driving Behavior Measure. Annual Meeting of the Gerontological Society of America. November 2011, Boston, MA.

**Bédard M.** Effectiveness of driver refresher courses and promising new programs. Annual Meeting of the Transportation Research Board. January 2011, Washington D.C.

**Riendeau J, Bédard M.** Confidence and driving performance among older adults. Annual Scientific and Educational Meeting of the Canadian Association on Gerontology. December 2010, Montreal, QC.

**Bédard M.** Best practices and ethical issues in knowledge translation. Annual Meeting of the Gerontological Society of America. November 2010, New Orleans, LA.

**Mullen N, Dubois S, Bédard M.** Fatality trends for younger, middle-aged, and older drivers and passengers. Annual Meeting of the Gerontological Society of America. November 2010, New Orleans, LA.

**Dubois S, Bédard M, Weaver B.** Pain killers and safe driving: An examination of the association between opioid analgesics and unsafe driving actions preceding fatal crashes. Annual Meeting of the Gerontological Society of America. November 2010, New Orleans, LA.

**Morrison L, Dubois S, Marks O, Mullen N, Bédard M.** The effects of passengers on older driver safety. Annual Meeting of the Gerontological Society of America. November 2010, New Orleans, LA.

**Bédard M, Kafka G.** Former drivers' reliance on family members for meeting their transportation needs. Annual Meeting of the Gerontological Society of America. November 2010, New Orleans, LA.

**Riendeau J, Bédard M.** The role of personality in predicting unsafe driving behavior: Comparisons between young and older adults. Annual Meeting of the Gerontological Society of America. November 2010, New Orleans, LA.

**Potter T, Haras K, Dubois S, Bédard M.** Transportation options: Comparing driver, vehicle and crash characteristics. Annual International Association for Experiential Education Conference, November 2010, Las Vegas, NV.

**Mullen N, Bédard M, Riendeau J, Rosenthal TJ.** Validating a driving simulator for measuring the effect of a lane departure warning system. STISIM Users Conference. October 2010, St. Petersburg, FL.

**Morrison L, Weaver B, Mullen N, Bédard M.** Using visual driving instructions to resemble a GPS on a simulated driving course (an update). STISIM Users Conference. October 2010, St. Petersburg, FL.

**Riendeau J, Bédard M, Weaver B.** The role of personality in predicting unsafe driver behaviour in young adults. Annual Meeting of the Canadian Psychological Association. June 2010, Winnipeg, MB.

**Bédard M.** Behaviors observed on the simulator and on the road. Annual Meeting of the Transportation Research Board. January 2010, Washington D.

Langford J, **Bédard M**, Charlton J. Can off-road screening tests assess older drivers' fitness to drive? Annual Meeting of the Transportation Research Board. January 2010, Washington D.C.

**Bédard M, Riendeau J, Weaver B, Porter MM.** Limited congruence between the Roadwise Review determination of safety to drive and on-road evaluations. Annual Meeting of the Gerontological Society of America. November 2009, Atlanta, Georgia.

**Bédard M, Dubois S.** The Fatality Analysis Reporting System: Crash data since 1975. Annual Meeting of the Gerontological Society of America. November 2009, Atlanta, Georgia.

Winter SM, Classen S, **Bédard M**, Lutz BJ, Velozo C, Lanford DN, Brumback B. Focus groups contributing to development of a Safe Driving Behavior Measure. Annual Meeting of the Gerontological Society of America. November 2009, Atlanta, Georgia.

**Kafka G, Bédard M.** Psychological resources variables are associated with driving cessation. Annual Meeting of the Gerontological Society of America. November 2009, Atlanta, Georgia.

Haras K, **Potter T, Dubois, S, Bédard M.** Application of the risk assessment & safety management model to 15-passenger van crashes. Annual International Conference of the Association for Experiential Education. October 2009, Montréal.

**Bédard M, Riendeau J, Weaver B, Porter MM.** Translating research into commercial products: Understanding common pitfalls. Canadian Multidisciplinary Road Safety Conference. June 2009, Niagara Falls, ON.

**Bédard M, Weaver B, Darzins P, Porter MM.** Choosing a test to predict driving abilities: Do not rely on statistical associations. Canadian Multidisciplinary Road Safety Conference. June 2009, Saskatoon.

**Weaver B, Bédard M, McAuliffe J, Parkkari M.** A simple (and free) attention task performs as well as the Useful Field of View (UFOV®) in predicting driving abilities. Canadian Multidisciplinary Road Safety Conference. June 2009, Saskatoon.

**Potter T, Haras, Dubois S, Bédard M.** Drive, vehicle and crash comparisons between 15-passenger vans and passenger vehicles. Canadian Multidisciplinary Road Safety Conference. June 2009, Saskatoon.

**Bédard M, Johnson MJ, Weaver B.** Driving simulation: Validation using physiological measurement. International Congress of the International Traffic Medicine Association. April 2009, The Hague, the Netherlands.

**Weaver B, Bédard M, McAuliffe J, Parkkari M.** Prediction of driving abilities: A simple attention task performs as well as the Useful Field of View (UFOV). International Congress of the International Traffic Medicine Association. April 2009, The Hague, the Netherlands.

**Bédard M, Weaver B, Darzins P, Porter MM.** Prediction of driving abilities: Statistical associations can be misleading. International Congress of the International Traffic Medicine Association. April 2009, The Hague, the Netherlands.

**Bédard M.** The potential of driving simulators to identify unsafe drivers. International Congress of the World Psychiatric Association. April 2009, Florence, Italy.

### ***3.4 Continuing education activities/outreach***

#### **3.4.1 Colloquium series**

- October 21, 2009: Dr. Tom Potter - "Fifteen Passengers Vans: Driver, Vehicle, and Crash Comparisons with Other Passenger Vehicles"
- October 26, 2009: Dr. Holly Tuokko (University of Victoria) – "NO PARTICULAR PLACE TO GO: Interdisciplinary Research On Older Driver Safety"
- October 26, 2009: Dr. David W. Eby (M-CASTL) – "Fitness to Drive in Early-Stage Dementia: An Instrumented Vehicle Study"
- November 25, 2009: Sacha Dubois – "Medications and Driving"
- December 17, 2009: Dr. Shawn Marshall (Ottawa Hospital Rehabilitation Centre, University of Ottawa) – "Driving After Brain Injury or Stroke"
- June 15, 2010: Dr. Judith Charlton (Monash University Accident Research Centre) – "Ageing, Vision, and Driving"
- June 15, 2010: Jim Langford (Monash University Accident Research Centre) – "What Does a Safe System Approach to Road Safety Mean?"



- September 13, 2010: Angela Bernt (University of Adelaide) – “Safe, Risky, Cautious, or Chaotic: Profiling Driver Performance in Dementia”
- April 14, 2011: Dr. Mark Rapoport (University of Toronto) – “Driving with Neuropsychiatric Illness in Late Life: Can we come to a Consensus based on Clinical and Epidemiological studies?”
- November 9, 2011: Dr. Juan Lupiáñez (University of Granada) - “The Importance of Considering Vigilance When Interpreting Network Scores from the Attention Network Test”
- April 19, 2012: Dr. Shep Siegel (McMaster University) – “The ghost in the addict: Drug anticipation and drug addiction”

### **3.4.2 Café Scientifique (CIHR-funded)**

- February 5, 2009: - "RxSky Driving: Medications and drugs: The driver's role to prevent crashes"
- October 26, 2009: Café Scientifique (CIHR-funded) - Maintaining Safe Driving and Transitioning to Non-driving Status

### **3.4.3 Thunder Bay Chronicle series (November 30 to December 7, 2010)**

- Nov. 30: Road safety up to everyone (Michel Bédard))
- Dec. 1: The safe systems approach (Paul Boase, Michel Bédard)
- Dec. 2: Chronic disease and fitness to drive (Neelam Khaper, Sacha Dubois)
- Dec. 3: Medications and safe driving (Sacha Dubois, Neelam Khaper)
- Dec. 4: Distracted driving can turn tragic (Bruce Weaver, Jim McAuliffe)
- Dec. 5: Bigger vans handle differently (Tom Potter, Sacha Dubois)
- Dec. 6: On the road to safer driving (Michel Bédard)
- Dec. 7: Retire from driving but keep on moving (Nadia Mullen)

### **3.4.4 Invited presentations**

- **Bédard M.** Aging drivers: Safety and cognitive testing. Ontario Association of Optometrists, Northwestern District, September 2012, Thunder Bay, ON.
- **Bédard M.** Driving Ethics: When is it fair to take away driving privileges? Centre for Health Care Ethics, Lakehead University, April 2012, Thunder Bay, ON.
- **Bédard M.** Driving simulator research: Success stories, trials, and tribulations. DriverLab Conference, Toronto Rehabilitation Institute, February 2012, Toronto, ON.

- **Bédard M.** Chronic diseases and aging. Standing Committee on Health, House of Commons, November 2011, Ottawa, ON.
- **Bédard M.** Research activities: Past, current, and future. Human Resources and Skills Development Canada, November 2011, Ottawa, ON.
- **Bédard M, Weaver B.** The Attention Network Test: A new approach to determine safety to drive? Conference on “The Eye and the Automobile” (TEATA), September 2011, Detroit, MI.
- **Bédard M.** Important test characteristics and statistical approaches to “fitness to drive”. Missouri Department of Transportation working group on fitness to drive in medically impaired drivers. St. Louis, June 2011.
- **Bédard M, Dubois S.** Drugs that impair driving. Ontario Provincial Police, Drug Recognition Expert Re-certification program. Thunder Bay, April, 2011.
- **Bédard M.** Le dépistage visant à identifier les conducteurs à risque: les directions actuelles, les défis et les aspects éthiques. Centre de recherche sur le vieillissement, Université de Sherbrooke, December 2010.
- **Bédard M.** Supporting aging drivers. St. Marks Men’s Group, Thunder Bay, November 2010.
- **Bédard M.** Driving simulators: Documentation of presence, validity and reproducibility. Transdisciplinarity in injury prevention research: Special focus on DWI. McGill University, October 2010, Montréal.
- **Bédard M.** Cognitive impairment in the aging driver: Assessment issues and the use of simulators. Canadian Association of Occupational Therapists. September 2010 (webinar).
- **Bédard M.** The impact of aging and dementia on safe driving. Geriatric Grand Rounds, Rependa Centre, City Hospital, June 2010, Saskatoon, Saskatchewan.
- **Bédard M.** Les conducteurs âgés: Promouvoir l’indépendance et diminuer les risques de collision. Université de Moncton, May 2010, Moncton, New Brunswick.
- **Bédard M.** AOTO pre-conference institute – Driving and community mobility. American Occupational Therapy Association, April 2010, Orlando.
- **Bédard M.** A researcher’s perspective on driving and dementia. 2010 Public Forum, Alzheimer Society of Thunder Bay. February 2010, Thunder Bay.

- **Bédard M.** Assessment of cognitive impairment in the aging driver and the emergence of simulators as a tool. Ontario Society of Occupational Therapists. October 2009, Toronto.
- **Bédard M.** CanDRIVE - Driving research for older adults. Municipal Retirees Organizations of Ontario. May 2009, Thunder Bay.
- **Bédard M.** Dementia and driving: Current issues. North West Ontario Dementia Network. March 2009, Thunder Bay.

#### 3.4.5 Other presentations (present and past members of the CRSD are in bold letters, trainees are underlined)

- Riendeau J, Patterson L. Self-rated confidence bears little relationship to actual on road driving performance in older adults. Poster session presented at the annual meeting of the AUTO21 Innovation through Research Excellence. May 2012, Montreal, QC.
- **Dubois S**, Maxwell H, **Weaver B**, **Bédard M.** The Impact of Some Common Medications, Alone and in Combination with Alcohol, on Crash Responsibility. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- **Potter T**, **Dubois S**, **Bédard M.** Risk of Rollover by Occupancy Rate among Automobiles, Minivans, 15-Passenger Vans, and Highway Busses. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- Lambert-Bélanger A, **Dubois S**, **Weaver B**, Mullen N, **Bédard M.** Aggressive Driving in Young Drivers. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- **Morrison L**, **Weaver B**, **Bédard M.** Relating Attention Network Test (ANT) Measures to Cognitive Test Scores for Driver Screening in Candrive Common Cohort Study Participants. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- Mullen N, Kafka G, **Bédard M.** Older Drivers' Driving Patterns and Satisfaction. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.

- **Mullen N, Kafka G, Bédard M.** Preparing for Driving Cessation: Does Health or Personality Make a Difference? 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- **Smith N, Dubois S, Mullen N, Bédard M.** A description of alcohol-impaired Canadian driver fatalities (1996-2006) by crash year, age and sex. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- **Mullen N, Ostap S, Bédard M.** Evaluating the Dem Test and SIMARD MD as Screening Tools for Older Drivers. 2012 Showcase of Health Research: Making a Difference, February 2012, Thunder Bay, Ontario, Canada.
- **Smith N, Dubois S, Mullen N, Bédard M.** description of alcohol-impaired Canadian driver fatalities (1996-2006) by crash year, age and sex. Lakehead University 2012 Research & Innovation Week Event, February 2012, Thunder Bay, Ontario, Canada.
- **Mullen N, Dubois S, Bédard M.** Observed, Estimated, and Projected Fatality Trends. Sixth Annual Northern Health Research Conference, Laurentian University, Huntsville, Ontario, June 2011.
- **Gates J., Dubois S., Mullen N., & Weaver, B.** *The impact of stimulants on transport truck driver culpability in fatal collisions.* Poster presented at the AUTO21 annual conference and exhibition, May 2011, Ottawa, Canada.
- **Gates J, Dubois S, Mullen N, Bédard M.** The impact of stimulants on transport truck driver culpability in fatal accidents. Poster presented at the annual St. Joseph's Care Group Showcase of Health Research, February 2011, Thunder Bay, Canada.
- **Morrison L, Dubois S, Mullen N, Bédard M.** The effect of passengers on older driver safety. Paper presented at the annual St. Joseph's Care Group Showcase of Health Research, February 2011, Thunder Bay, Canada.
- **Mullen N, Bédard M.** Speed reduction program decreases speed of younger men on a simulated drive. Poster presented at the annual St. Joseph's Care Group Showcase of Health Research, February 2011, Thunder Bay, Canada.
- **Mullen N, Bédard M, Riendeau J, Rosenthal T.** Validating a driving simulator for measuring the effects of a lane departure warning system. Poster presented at the annual St. Joseph's Care Group Showcase of Health Research, February 2011, Thunder Bay, Canada.
- **Mullen N, Dubois S, Bédard M.** Observed, estimated, and projected fatality trends. Poster presented at the annual St. Joseph's Care Group Showcase of Health Research, February 2011, Thunder Bay, Canada.

- **Gates, J., Dubois, S., Mullen, N., & Bédard, M.** *The impact of stimulants on transport truck driver culpability in fatal accidents.* Poster presented at the Lakehead University Research and Innovation Week, February 2011, Thunder Bay, Canada.
- **Morrison, L., Dubois, S., Mullen, N., & Bédard, M.** *The effect of passengers on older driver safety.* Poster presented at the Lakehead University Research and Innovation Week, February 2011, Thunder Bay, Canada.
- **Mullen, N., Diamond, L., Riendeau, J., Weaver, B., & Bédard, M.** *Enhancing safe vehicular mobility* (updated). Poster presented at the Lakehead University Research and Innovation Week, February 2011, Thunder Bay, Canada.
- **Mullen, N., Dubois, S., & Bédard, M.** *Observed, estimated, and projected fatality trends.* Poster presented at the Lakehead University Research and Innovation Week, February 2011, Thunder Bay, Canada.
- **Mullen, N., Bédard, M., Riendeau, J., & Rosenthal, T.** *Validating a driving simulator for measuring the effects of a lane departure warning system.* Poster presented at the Lakehead University Research and Innovation Week, February 2011, Thunder Bay, Canada.

## 4 Members

### 4.1 Current Full/Associate Members of the Centre

| Name             | Membership category | Primary affiliation     |
|------------------|---------------------|-------------------------|
| Bédard, Michel   | Full/Director       | Health Sciences         |
| Dubois, Sacha    | Associate           | St. Joseph's Care Group |
| Gibbons, Carrie  | Associate           | St. Joseph's Care Group |
| Hayman, Gordon   | Full                | Psychology              |
| Johnson, Michel  | Associate           | Université de Moncton   |
| Khaper, Neelam   | Full                | NOSM                    |
| Klein, Rupert    | Full                | Psychology              |
| McAuliffe, Jim   | Associate           | Nipissing University    |
| Mushquash, Chris | Full                | Psychology              |
| Newhouse, Ian    | Full                | Kinesiology             |
| O'Connor, Brian  | Associate           | UBC Kelowna             |
| Pernia, Juan     | Full                | Civil Engineering       |
| Potter, Tom      | Full                | Outdoor Recreation      |
| Ross, Brian      | Full                | NOSM                    |
| Suntres, Zach    | Full                | NOSM                    |
| Weaver, Bruce    | Full                | Health Sciences/NOSM    |

## **4.2 Current and Past Trainees of the Centre**

| <b>Name</b>                   | <b>Training level</b> | <b>Primary affiliation</b> |
|-------------------------------|-----------------------|----------------------------|
| <b>Chahal, Tammem</b>         | Master                | Kinesiology                |
| <b>Chattha, Harpreet</b>      | Doctoral              | Psychology                 |
| <b>Couture, Brenda</b>        | Master                | Health Sciences            |
| <b>Dubois, Sacha</b>          | Master                | Health Sciences            |
| <b>Franks, Jessica</b>        | Master                | Psychology                 |
| <b>Gates, Justin</b>          | Master                | Psychology                 |
| <b>Ghaffaryhagh, Alireza</b>  | Undergraduate         | Civil Engineering          |
| <b>Kafka, Garrett</b>         | Doctoral              | Psychology                 |
| <b>Lambert-Bélanger, Anik</b> | Master                | Health Sciences            |
| <b>Marks, Owen</b>            | Doctoral              | Psychology                 |
| <b>Maxwell, Hillary</b>       | Research Coordinator  | CRSD                       |
| <b>Morrison, Laura</b>        | Research Coordinator  | CRSD                       |
| <b>Mosstojiri, Pouya</b>      | Undergraduate         | Civil Engineering          |
| <b>Mullen, Nadia</b>          | Post-Doctoral Fellow  | CRSD                       |
| <b>Ostap, Simeon</b>          | Master                | Psychology                 |
| <b>Patel, Arif</b>            | Undergraduate         | Civil Engineering          |
| <b>Patterson, Loretta</b>     | Doctoral              | Psychology                 |
| <b>Peltonen, Jennifer</b>     | Master                | Psychology                 |
| <b>Reguly, Paula</b>          | Master                | Health Sciences            |
| <b>Riendeau, Julie</b>        | Doctoral              | Psychology                 |
| <b>Smith, Nathan</b>          | Master                | Health Sciences            |
| <b>Trerice, Andrew</b>        | Undergraduate         | Kinesiology                |
| <b>Witcher, Chad</b>          | Post-Doctoral Fellow  | CRSD                       |
| <b>Zarezadeh, Mohammad</b>    | Undergraduate         | Civil Engineering          |
| <b>Zozula, Christina</b>      | Master                | Health Sciences            |

## **4.3 Prizes/awards**

Julie Riendeau (Psychology) and Loretta Patterson (Psychology) were Round 1 Winner and received an Honourable Mention for the Oral Defence at the 2012 AUTO21 Poster Competition.

Loretta Patterson (Psychology) received the St-Joseph's Care Group Scholarship in Applied Health Research and a CIHR doctoral fellowship for her research.

Julie Riendeau (Psychology) received a SSHRC doctoral fellowship for her research.

Harpreet Chattha (Psychology) received a CIHR doctoral fellowship for her research.

Nathan Smith (Health Sciences) received the St-Joseph's Care Group Scholarship in Applied Health Research for his research.

Sacha Dubois (Health Sciences) received the Age+ Award (CIHR – Institute on Aging) for his thesis research.

Nadia Mullen (CRSD) received a Post-Doctoral Fellowship from the CanDRIVE program. CanDRIVE is a CIHR-funded team Grant aiming "...to improve the health, safety and quality of life of Canada's older drivers."

Nadia Mullen (CRSD), Laura Diamond (CRSD), Julie Riendeau (Psychology), and Bruce Weaver (Health Sciences/NOSM) were selected in the top 10 for their poster presentation at the 2009 AUTO21 Scientific Conference.

Michel Bédard (Health Sciences) was elected Fellow of the Gerontological Society of America.

## 5 Financial reports

| Expenditures                     | 2011- 2012     | 2010-2011      | 2009-2010      | 2008-2009      |
|----------------------------------|----------------|----------------|----------------|----------------|
| <b>Personnel</b>                 |                |                |                |                |
| <i>-Post-Doctoral Fellow</i>     | 50,000         | 45,000         | 40,000         | 40,000         |
| <i>-Research Associate (PT)</i>  | 45,000         | 38,000         | 35,000         | 34,000         |
| <i>-Research Coordinators</i>    | 100,000        | 61,630         | ---            | ---            |
| <i>-Research Assistants</i>      | 145,000        | 101,000        | 40,000         | 22,500         |
| Research management              | 20,000         | 15,000         | 6,000          | 6,000          |
| Sub-grant awards                 | 250,000        | 176,000        | 5,000          | 5,000          |
| Travel (staff/invited lecturers) | 12,000         | 10,000         |                |                |
| Equipment/supplies               | 5,386          | 5,000          |                |                |
| <b>Total</b>                     | <b>627,386</b> | <b>451,630</b> | <b>126,000</b> | <b>107,500</b> |
| <b>Income</b>                    |                |                |                |                |
| External grants                  | 627,386        | 451,630        | 89,500         | 70,000         |
| Internal funds                   | 0              | 0              | 37,500         | 37,500         |
| <b>Total</b>                     | <b>627,386</b> | <b>451,630</b> | <b>127,000</b> | <b>107,500</b> |

## **6 Five-year plan: future research directions and development strategies**

The proposed program activities are geared towards further development of a body of knowledge about safe driving and represent the evolution of the CRSD's current research programs. The proposed research will continue to be guided by the model presented earlier. These themes will entail the involvement of various members of the Centre and outside collaborators. Our rationale for choosing the projects was based on the following criteria: 1) ability to build on existing projects, 2) availability of equipment and resources, 3) availability of expertise, and 4) opportunities for the development of projects in each of the three levels (driver, car, road).

### ***6.1 Development of a framework and protocols for the assessment of fitness-to-drive and for training opportunities***

This represents one of the most ambitious elements of the research plan for the coming years. There is an emerging agreement on the framework that should be used to assess fitness-to-drive but it requires more work and the development of a clear consensus. Furthermore, the development of the tools and protocols to determine who is fit-to-drive and who is not requires additional research and a critical perspective based on a sound knowledge translation plan rather than an approach that seeks to commercialize products that are not ready for implementation. The CRSD is committed to developing a valid, fair, and transparent approach to assessing fitness-to-drive, and working with policy-makers and clinicians to ensure that unsafe drivers are identified and provided with opportunities to improve on their skills whenever possible.

### ***6.2 Driver training***

The training aspect is intimately link to assessment issues. First, it is problematic to identify unsafe drivers without having something to offer to improve on driving skills; for some individuals, remediation may allow them to continue driving safely. Second, there is value, from an injury prevention perspective, in improving everyone driving skills. Third, automobile technology and road infrastructure are changing rapidly and will require adjustments on the part of drivers; the development of new skills and strategies may be required to maintain safety. Hence, we plan on continuing and expanding on previous work towards the development of training programs to enhance the skills of current and future drivers. New approaches towards training such simulator technology may provide important benefits.

### ***6.3 Drug and safe driving***

We plan on continuing our work to determine the impact of drugs (licit and illicit) on driving performance. We will continue to use administrative databases such as U.S. Fatality



Analysis Reporting System (we have data going back to 1975) and have made arrangements to secure access to equivalent Canadian data. We also plan on increasing our work using experimental designs. As mentioned earlier we developed a protocol that could be used to examine the effects of drugs on performance. This protocol will anchor future studies.

#### **6.4 *Driving cessation***

Following the preparation of a book chapter on the issue of “driving cessation” (Mullen and Bédard, 2009) we have been setting the stage for the thorough examination of the issue. We have worked on developing a tool to examine the impact of driving status on quality of life, and in recruiting senior drivers from the Candrive cohort (n = 928) to follow them longitudinally as they transition from driving to non-driving status. This study and others we will initiate are meant to help us better understand the consequences of driving cessation, and the barriers and enablers towards a successful transition.

#### **6.5 *Under-studied populations***

As mentioned earlier there are important research opportunities related to road safety for Aboriginal populations (Short et al, submitted). We will pursue opportunities to engage in such research. Furthermore, traffic-related injuries are rapidly becoming the number one prevention issue in developing countries. These countries are experiencing a rapid expansion in automobile access without the concomitant increases in infrastructure and regulation. Lessons learnt from more developed countries may be valuable to curb current increases in morbidity and mortality. One of our members is currently exploring research opportunities in this area.

#### **6.6 *Development strategies***

Our primary strategy to continue the development of the CRSD is focused on peer-reviewed grants. We have in the past four years experienced a significant increase in funding, allowing us to tackle more issues. An important underpinning of this strategy is to support the involvement of as many researchers as possible (including trainees) in the CRSD’s activities. We believe we have been successful in this respect but more work needs to be done. Other opportunities to grow the CRSD include applying for large team grants, infrastructure development grants, and possibly the development of provincial/national/international networks.

**7 Statements from appropriate Department Chair(s), Director(s) and Dean(s) indicating continued support for the Centre or Research Institute**

The following individuals will provide letters of support:

Dr. Lori Livingston, Dean, Faculty of Health and Behavioural Sciences

Dr. Glenna Knutson, Chair, Department of Health Sciences

**8 Names of persons who could provide external assessments of the Centre or Research Institute**

Names will be provided if an external assessment is required.