



**THE STROKE
REHABILITATION
CENTER**
OF SOUTHEASTERN WISCONSIN



2018 Annual Report



THE STROKE REHABILITATION CENTER

OF SOUTHEASTERN WISCONSIN

Dear Colleagues,

It is our great pleasure to provide this Stroke Rehabilitation Center (SRC) annual report for your review. Over the last three years, with funding from Advancing Healthier Wisconsin “Optimizing Functional Outcomes of Stroke Survivors through Translational Research” and other funding sources, we have seen significant progress toward achieving our SRC goals.

The annual report highlights the strength of our partnership with Marquette University Department of Physical Therapy, MCW & MU Department of Biomedical Engineering, MCW Department of PM&R, CTSI, our Froedter health system partner and community.

As we move forward, our goal is to further achieve advancements in rehabilitative care for stroke survivors, improving wholistic functional outcomes through innovation.

We appreciate your support of the SRC and remain grateful to our partnering institutions for facilitating this collaboration. We offer our sincere appreciation to the CTSI and Dr. David Harder, who provided mentorship to us in the initial stages of the SRC.

Sincerely,

Diane W. Braza, MD
Chair, Physical Medicine and Rehabilitation
Medical College of Wisconsin

Jeanne Hossenlopp, PhD
Vice President for Research and Innovation
Marquette University



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Brian Schmit, PhD
Co-Director



John McGuire, MD
Co-Director

We have seen many outstanding developments in the Stroke Rehabilitation Center of Southeast Wisconsin (SRC) in the past year. Stroke rehabilitation research is continuing to grow with many strong publications in stroke rehabilitation research from our faculty. Much of this work is leveraged by the SRC's Stroke Survivor Recruitment Database which is continually expanding to connect stroke survivors and researchers to advance targeted stroke rehabilitation research. Advancing stroke rehabilitation research through the intersection of clinical care and translational research is central to the SRC's mission.

The Department of Physical Medicine and Rehabilitation has built one of the largest comprehensive spasticity management programs in the country. This year we hired two new faculty members in Physical Medicine and Rehabilitation. Brian Robertson-Dick, MD and Erin McGonigle, MD are outstanding clinicians dedicated to advancing collaborative stroke rehabilitation research that will increase function for stroke survivors. Drs. Robertson-Dick ('18) and McGonigle ('16) both completed the Spasticity and Neurorehabilitation Fellowship at Froedtert and the Medical College of Wisconsin. Our new faculty members have increased capacity to give stroke survivors the state of the art, cutting edge care they deserve through a stroke clinic to provide specialized care for stroke survivors. Of note, Dr. Robertson-Dick teamed up with our new graduate research assistant, Mr. Douglas Gobeski, on a project aimed at examining balance function in people with stroke. The opportunity to connect a clinical

trainee and a translational research trainee was an important accomplishment this year. We welcomed Dr. Molly Agnew to the SRC as a research therapist to aid in the development of our Functional Outcomes Toolkit, and the potential to serve as a resource for future research projects.

Our Community Academic Advisory Board was extremely active this year on four important projects with impact on the stroke community. Our clinical expertise coupled with advanced stroke rehabilitation research and the power of a community of stroke survivors and their loved ones has positioned the SRC to become a premier destination for stroke rehabilitation. We hope you will join us for another year of better outcomes for stroke survivors through clinical and translational research.

Sincerely,

Brian Schmit, PhD
Professor
Biomedical Engineering
Marquette University

John McGuire, MD
Professor
Physical Medicine and Rehabilitation
Medical College of Wisconsin



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Transforming the lives of stroke survivors in Southeastern Wisconsin through clinical and translational research

The National Institutes of Health have prioritized stroke prevention and acute treatment as important research areas; however, there is less attention and research focused on rehabilitation following stroke to improve the quality of life of stroke survivors. As survivor rates post-stroke continue to rise, the Stroke Rehabilitation Center for Southeast Wisconsin (SRC) is one of the few centers in the country focused on developing state-of-the-art, interdisciplinary stroke rehabilitation research programs which utilize cutting-edge technology and clinical programs to improve stroke survivors' long-term functional outcomes across the continuum of care. The Marquette University and Medical College of Wisconsin Stroke Rehabilitation Center of Southeastern Wisconsin (SRC) infrastructure, which includes Moriah Iverson, MS Program Manager, and Rachel Minkin, MS Clinical Research Coordinator and six core faculty

including Diane Braza, MD, Brian Schmit, PhD, John McGuire, MD, Matt Durand, PhD, Allison Hyingstrom, PT, PhD, and Sheila Schindler-Ivens, PT, PhD, is dedicated to improving stroke survivors' functional recovery, independence and quality of life through rehabilitation research. In addition, we have Fellows in the Department of Physical Medicine and Rehabilitation at the Medical College of Wisconsin who have dedicated and protected time for research as well as graduate students in Brian Schmit, Allison Hyingstrom, and Sheila Schindler-Ivens' lab at Marquette University. The SRC works with stroke survivors through the Froedtert & Medical College of Wisconsin Stroke and Neurovascular Center, located at Froedtert Hospital, and is focused on improving the quality of life of stroke survivors by:

- Enhancing and streamlining assessment of stroke survivors' progress to develop more effective rehabilitation strategies.
- Developing neuroimaging tools to improve prediction of recovery.
- Creating new, intensive rehabilitation interventions to improve function of stroke survivors in the first three months after stroke.

“Being part of the SRC provides a valuable infrastructure for my team. Our goal is to improve the lives of stroke survivors through innovative, cutting edge, multidisciplinary research.”



Matt Durand, PhD
Assistant Professor
PM&R, Medical College of Wisconsin
SRC Core Member



Support for clinical and translational research

“The SRC has had a large impact on advancing my research program through streamlined participant recruitment. Using the Stroke Survivor Recruitment Database, I was able to transition from mechanistic studies to clinical trials. Ultimately, this will help the translation of scientific research in to clinical practice.”



Allison Hyngstrom, PhD, PT
Chair, Physical Therapy
Marquette University
SRC Core Member

Advancing a Healthier Wisconsin

The goal of the Advancing a Healthier Wisconsin Endowment (AHW) is big –transform and sustain the health of the Southeastern Wisconsin community. The mission of the SRC to optimize functional outcomes for stroke survivors through clinical and translational research directly aligns with that goal, and we have been fortunate to receive support for our cutting-edge research projects through a 5-year award from AHW. Current SRC research studies funded by AHW include: a) The Stroke Survivor Recruitment Database (SSRD), b) The Functional Outcomes Toolkit Study, c) Ischemic Preconditioning as an Intervention to Improve Stroke Rehabilitation, d) Changes in Brain Activation with Botulinum Toxin Therapy for Spasticity, and e) A New Training Paradigm to Reduce Motor Compensation During Pedaling in Subacute Stroke. All of these projects have touched the lives of stroke survivors and propel increases in functional outcomes forward, both in the clinic and in the everyday lives of survivors.

Stroke Survivor Recruitment Database (SSRD)

- **Principal Investigator:** Matt Durand, PhD
- **Summary:** Searchable database for study investigators to contact interested potential stroke survivor research participants.
- **Recruitment:** Began 2/17. Froedtert Hospital inpatient units and Physical Medicine and Rehabilitation and Neuroscience outpatient clinics.
- **Status:** Currently enrolling. 156 Stroke survivors enrolled in the database in FY2018.

Functional Outcome Toolkit Study

- **Principal Investigator:** John McGuire, MD
- **Summary:** A panel of validated outcome measures in motor, sensory, cognitive and psychosocial function to measure functional status. This will give clinicians and researchers the power to reliably measure the impact of rehabilitation intervention on functional outcomes over time.
- **Recruitment:** Began 5/18. SSRD and FH inpatient rehabilitation unit
- **Status:** Currently enrolling. 5 participants with chronic stroke, 4 participants with acute stroke.



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Ischemic Preconditioning as an Intervention to Improve Stroke Rehabilitation (IPC)

- **Principal Investigators:** Matt Durand, PhD and Allison Hyingstrom, PT, PhD
- **Summary:** Well-tolerated intervention during which blood flow to a certain part of the body is temporarily cut off using a blood pressure cuff.
 - IPC has shown to improve regional blood flow, motor neuron active and muscle function.
 - IPC has shown to be effective in chronic stroke survivors and we are now exploring the effects of IPC on inpatient acute stroke survivors.
- **Recruitment:** Began 12/16. FH PM&R outpatient clinic, FH inpatient rehabilitation unit
- **Status:** Closed to enrollment 6/18, data analysis ongoing. 27 participants with chronic stroke and 15 with acute stroke

This project was submitted as multi-PI NIH R01 (Durand and Hyingstrom PIs) and inpatient project submitted as NIH R21 (Durand PI), and is in concept development for a StrokeNet project.

Changes in Brain Activation with Botulinum Toxin Therapy for Spasticity

- **Principal Investigators:** John McGuire, MD and Brian Schmit, PhD.
- **Summary:** Botox injection therapy can be helpful in relieving muscle tightness and improving movement and overall physical function. This study identifies changes in brain connections in response to botulinum toxin therapy in stroke survivors prior to injection of botulinum toxin for treatment of spasticity and at 6 weeks post-injection.
- **Recruitment:** Began 10/17. SSRD
- **Status:** Closed to enrollment, data analysis ongoing. 10 participants with chronic stroke, and 10 non-stroke controls.

Initial results suggest increases in brain activation following therapy and increases in local brain connectivity.

A New Training Paradigm to Reduce Motor Compensation During Pedaling in Subacute Stroke

- **Principal Investigator:** Sheila Schindler-Ivens, PT, PhD
- **Summary:** Motor compensation after stroke is a behavior in which the unaffected limb performs tasks that are normally accomplished with the affected limb. Pedaling is used as a model for compensation during walking.
 - Brain activity is altered during pedaling in stroke survivors.
 - Participants will be trained to decrease compensation while pedaling on a device with small motors assisting the movement. This will translate to improvements in walking.
- **Recruitment:** SSRD
- **Status:** Closed to enrollment. Data analysis ongoing.

Submitted as an NIH R01.

Institutional support

Additional stroke-related research projects have been conducted in the affiliated research laboratories of the SRC. Funding for these projects has come through institutional support and support for research fellowships through the SRC. These projects make use of the SSRD for recruitment of study participants. Projects include a) Electroencephalographic measurements of arm movements in stroke, b) Changes in brain signals with fatigue post stroke, c) Altered dynamic stability in stroke survivors and d) Imaging of structural changes in the brain after stroke.



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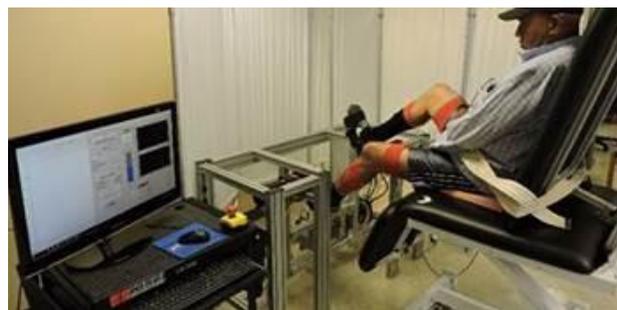
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Electroencephalographic measurements of arm movements in stroke

- **Principal Investigators:** Brian Schmit, PhD and Scott Beardsley, PhD
- **Summary:** The sensory signals influencing control of arm movement are altered in people with stroke. Altered sensorimotor networks controlling arm stabilization might underlie errors in control of arm movement.
 - Cortical signals are associated with stabilization.
 - Vibration alters cortical networks associated with arm movement
 - Resting state brain networks identified using electroencephalography are altered in stroke survivors.
- **Recruitment:** 10 participants with chronic stroke, 20 nonstroke controls
- **Status:** Closed to enrollment.

Changes in brain signals with fatigue post stroke

- **Principal Investigators:** Brian Schmit, PhD, Allison Hyngstrom, PhD
- **Summary:** Central fatigue is common in stroke survivors and could be the result of an inability to maintain descending drive.
 - Fatigue is being tested while measurements of electroencephalography and high-density electromyography of the wrist flexors is being conducted.
 - Electroencephalography measurements of brain activation are altered by fatigue, with evidence of decreases brain activity with fatigue in people with stroke.
- **Recruitment:** Began 3/17. SSRD, 5 participants with chronic stroke, 5 nonstroke controls.
- **Status:** Open to enrollment.



A trainee tests the pedaling device in the lab of Sheila Schindler-Ivens, PhD (Marquette University)

Altered dynamic stability in stroke survivors

- **Principal Investigators:** Brian Robertson-Dick, MD and Brian Schmit, PhD
- **Summary:** Walking balance limits gait in people with stroke. Using a novel treadmill system mounted on a motion base, responses to balance perturbations were examined in people with stroke.
 - People with stroke appear to have an asymmetric response to balance perturbations
 - People with stroke alter the way in which they synchronize with cyclical movements of the walking surface.
- **Recruitment:** SSRD, 10 participants with stroke, 10 nonstroke participants
- **Status:** Closed to enrollment. Data collection ongoing.



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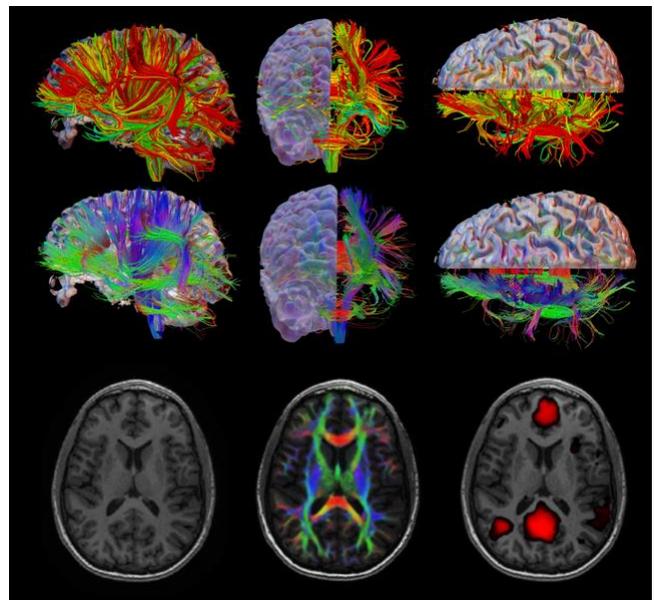
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Imaging of structural changes in the brain after stroke

- **Principal Investigators:** Brian Schmit, PhD and Karin Goodfriend, MD
- **Summary:** Imaging of brain structure was conducted along with functional outcomes measurements in people with stroke.
 - Brain structural connectivity, measured using indirect connectivity, correlates with functional outcomes measures in people with stroke.
- **Recruitment:** SSRD
- **Status:** Open to enrollment.

Giving to the SRC

We are incredibly fortunate to have the support of donors who are passionate about stroke rehabilitation. Advancing research in how the affected limb is sensed is critical to developing rehabilitation tools and practices to increase the independent function and safety for stroke survivors. A generous gift supports this project.



Images of a stroke survivors brain taken at the Imaging Core at the Medical College of Wisconsin. Researchers in the SRC are able to utilize advanced technology resources to drive their studies. Image credit: Brian Schmit, PhD.

Wearable Technology to Improve Proprioception in Stroke Survivors

- **Principal Investigators:** John McGuire, MD and Robert Scheidt, PHD
- **Summary:** Changes in proprioception after stroke can result in difficulty sensing where the affected limb is in space, leading to increased risk for injury and decreased function.
 - Stroke survivors were engaged to help design a wearable bracelet that used vibration and light to draw attention to the affected limb
- **Recruitment:** SSRD
- **Status:** A pilot study is in preparation to evaluate clinical efficacy

Gifts to the SRC also supported the purchase of the *GAITrite®* system. This portable, single layer mat allows researchers to measure abnormalities in the way stroke survivors walk. Researchers can better understand mobility after stroke, and the power to measure the effects on rehabilitation on mobility. We were also able to purchase a GE Vivid i portable ultrasound system equipped with a 13 MHz linear probe. This important equipment is used to measure blood flow in the femoral artery of stroke survivors while they exercise, as well as to measure the ability of different arteries to dilate.



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Sharing our research with the academic and clinical community

SRC researchers share results through manuscripts published in peer review journals, conference proceedings at national meetings, and presentations. SRC faculty members also submit competitive, rigorous grants to fund their work through philanthropy, institutional awards, and federal funding.

Publications

Hyingstrom AS, Murphy SA, Nguyen J, **Schmit BD**, Negro F, Gutterman DD, **Durand MJ**. Ischemic conditioning increases strength and volitional activation of paretic muscle in chronic stroke: a pilot study. *J Appl Physiol* (1985). 2018 May 1;124(5):1140-1147. doi: 10.1152/jappphysiol.01072.2017. Epub 2018 Feb 8. PMID: 29420152

Kalinosky BT, Berrios Barillas R, **Schmit BD**.

Structurofunctional resting-state networks correlate with motor function in chronic stroke. *Neuroimage Clin*. 2017 Jul 29;16:610-623. doi: 10.1016/j.nicl.2017.07.002. eCollection 2017. PMID: 28971011

Wissel, J, Bensmail D, Ferreira JJ, Molteni F, Satkunam L, Moraleda S, Rekand T, **McGuire J**, Scheschonka A, Flatau-Baqué B, Simon O, Dressler D, Simpson DM. Safety and efficacy of incobotulinumtoxinA doses up to 800 U in limb spasticity: The TOWER study. *Neurology*. April 4, 2017.

Esquenazi A; Alfaro A; Ayyoub Z; Charles D; Dashtipour K; Graham GD; **McGuire JR**; Odderson IR, Patel AT, Simpson DM. OnabotulinumtoxinA Injection for Lower Limb Spasticity: Guidance From a Delphi Panel Process. *PM&R*. Apr, 13, 2017.

Cleland BT, **Schindler-Ivens SM**. Brain activation during passive and volitional pedaling post-stroke. *Motor Control*. [in press]

Abstracts

Matthew J. Durand, Spencer A. Murphy, **Brian D. Schmit**, David D. Gutterman and **Allison S. Hyingstrom**. Two Weeks Of Ischemic Preconditioning Training On The Paretic Leg Improves Leg Strength And Delays Muscle Fatigue in Chronic Stroke. *Stroke*. 2017;48:ATP150

Timothy Boerger, Rebecca Palarz, Jennifer Nguyen, **Brian Schmit**, **Matthew Durand** and **Allison Hyingstrom**. The Effects of Ischemic Conditioning on Walking Function in Chronic Stroke Survivors: A Pilot Study. APTA Combined Sections Meeting 2018

“One great thing about the SRC is the collaboration. It brings together patients, physicians, and providers of many different backgrounds in a multi-disciplinary way. We're one big team accomplishing together what none of us could do alone.”



Brian Robertson-Dick, MD
Assistant Professor
PM&R, Medical College of Wisconsin
SRC Core Member



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“By being part of the SRC team, I help advance our research to improve the functional recovery and rehabilitation of stroke survivors. It is an honor and privilege to be able to meet with survivors and work with them to achieve their goals”



Rachel Minkin, MS
Clinical Research Coordinator
SRC Staff

Chronic Stroke Survivors on a Vertically Oscillating Treadmill. Annual meeting of the Society for Neuroscience, 2018 Nov 03-07; San Diego, California.

Miguel Sotelo, **Brian D. Schmit**. Whole-brain indirect structural connectivity detects loss of cerebellar connectivity after stroke Annual meeting of the Society for Neuroscience, 2017 Nov 11-15; Washington DC.

Kaleb Vinehout, **Sheila Schindler-Ivens, Brian D. Schmit**. Identify Local and Global Functional Connectivity Dependence on Lower Limb Motor Tasks in Stroke Survivors [abstract]. In: Annual Meeting of the Biomedical Engineering Society; 2018 Oct 17-20; Atlanta, Georgia (GA): BMES; 2018. nr 436. In review.

Sheila. M. Schindler-Ivens, Brian. D. Schmit, Kaleb Vinehout. Detection of altered network function after stroke is task-dependent [abstract]. Annual Meeting of the Society for Neuroscience; 2018 Nov; San Diego, CA. In review

Matthew J. Durand, Jennifer N. Nguyen, Michael T. Wright, Stephanie C. Raab, David D. Gutterman, **Brian D. Schmit**, and **Allison S. Hyngstrom**. Evaluation of Knee Extensor Muscle Strength and Femoral Artery Blood Flow in Subacute Stroke Patients Admitted to Inpatient Rehabilitation - a Feasibility Study. *Stroke*. 2018; 49: ATP 143

Presentations

Brain Imaging in Stroke Rehabilitation, MCW PM&R Grand Rounds 3-16-2018

Kaleb Vinehout, **Sheila Schindler-Ivens, Brian D. Schmit**. Identify Local and Global Functional Connectivity Dependence on Lower Limb Motor Tasks in Stroke Survivors. Annual Meeting of the Biomedical Engineering Society; 2018 Oct 17-20; Atlanta, Georgia.

Lara Riem, Scott Beardsley, **Brian D. Schmit**. The effect of medial-lateral visual displacements on center of mass shifts during stepping through an immersive virtual environment. Annual Meeting of the Biomedical Engineering Society; 2018 Oct 17-20; Atlanta, Georgia.

Stephanie C. Raab, Brian Robertson-Dick, Douglas Gobeski, Tanya Onushko, Lara Reim, **Allison S. Hyngstrom, Brian D. Schmit**. Entrainment of Stepping Frequency in



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Evaluation of Knee Extensor Muscle Strength and Femoral Artery Blood Flow in Subacute Stroke Patients Admitted to Inpatient Rehabilitation - a Feasibility Study. International Stroke Conference 01-25-2018

Ischemic Conditioning Improves Motor Function Post-Stroke: A Team Science Approach. MCW Neurology Grand Rounds, 4-13-2018

Stroke Rehabilitation – Considerations for Blood Flow and Exercise. Conversations with Scientists: Your Heart and Blood Vessels Series, 11-15-2017

AAPM&R Annual Assembly 2017, Denver CO: Resident Spasticity Workshop, 10-11-2017
Ultrasound Guidance workshops 10-12 and 10-13-2017

NANS: Las Vegas NV 1-11-2018 Troubleshooting Intrathecal Delivery Systems

AAP: Atlanta GA; Resident Spasticity Workshop, 2-14-2018

Advances and Controversies in Botulinum Toxin Therapy for Spasticity, 2-15-2018

Advancing stroke recovery through training for future clinicians and researchers

There has historically been an impression that stroke rehabilitation was static and that impairments in function could not be improved. With exciting research and clinical discoveries, that is no longer the case. Clinical and translational research facilitates exponential growth in the area of new rehabilitation therapies and tools, and advanced clinical care for stroke survivors. This provides an excellent environment for clinical and research trainees in the fields of physical therapy, biomedical engineering and others to collaborate and enhance our capacity to develop research that quickly moves from the lab to the clinic. Educating medical students, residents, fellows and graduate students on the advances in stroke recovery, and the potential for exciting new research opportunities is a critical component of the SRC mission.



Nick Donahue, MD (PGY2, left) and Sheila Bhaat, MD (PGY4, center) learn about the use of ultrasound in spasticity from Brian Robertson-Dick, MD during our resident lecture series.

The Education Program at the SRC includes didactic curriculum on comprehensive stroke rehabilitation for our residents, the SRC Stroke Fellowship, and SRC Graduate Research Fellowship. We are grateful to the pharmaceutical companies that support our clinical fellowship program, and the Department of Biomedical Engineering at Marquette University and the Medical College of Wisconsin for supporting the research fellowship program. Sustaining advanced educational programs for trainees is critical to advance care for stroke survivors.



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The Human Performance Lab at Marquette University. Doug Gobeski (SRC Graduate Fellow) and Brian Robertson-Dick, MD (SRC Research Fellow) collaborated on a project utilizing this advanced technology.

Resident Education Program

The SRC implemented a twelve-week didactic as part of our resident training program in the Department of Physical Medicine and Rehabilitation at the Medical College of Wisconsin. The lecture series included a site visit to Dr. Schmit's lab at Marquette University, where residents were able to learn about cutting edge research on stroke rehabilitation. Former SRC Stroke Fellows Brian Robertson-Dick, MD and Karin Goodfriend, MD gave lectures on acute stroke management, stroke syndrome, aphasia/dysphagia, gait analysis, motor recovery and spasticity management.

Fellowship Programs

2018 SRC Clinical Fellow

Brian Robertson-Dick, MD was the 2018

Stroke Fellow through the SRC. Dr. Robertson-Dick conducted his research project in the Integrative Neural Engineering Laboratories at Marquette University. He led a research team that included the SRC graduate research assistant in biomedical engineering, Douglas Gobeski, a graduate student in the Clinical Translational Rehabilitation Health program, Stephanie Raab, and an undergraduate biomedical engineering student, Lara Reim. Under the direction of Brian Schmit, PhD, training activities were conducted that included defining the problem, literature review, articulating the hypothesis, experimental design, data collection and data analysis. He conducted the study 'Altered dynamic stability in stroke survivors' described in the research section of this report.

2018 SRC Graduate Research Fellow

The 2018 SRC Graduate Research Fellow was Douglas Gobeski, an entering student in the PhD program in Biomedical Engineering. In addition to his coursework, Mr. Gobeski assisted Brian Robertson-Dick in the research project 'Altered dynamic stability in stroke survivors'. His research training focused on the technical components of the project including work with the treadmill and the development of algorithms for analysis of treadmill walking data. Mr. Gobeski is interested in developing haptic interfaces to improve gait symmetry and functional ambulation.

Caring for stroke survivors through comprehensive stroke management

Increasing collaborations with Neurorehabilitation at Froedtert Hospital

With the addition of a Research Therapy position to the SRC, we have seen an improved collaboration between the Neuro Rehabilitation Department and the Physical Medicine and Rehabilitation Departments and a reinforcement of commitment to continue to provide best practice care to achieve optimal outcomes for the patients we serve. We anticipate as the



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Toolkit Project and other research projects progress, there will be ongoing improvements to therapeutic intervention and overall clinical care for individuals with stroke.

Excellence in targeted clinical care continues to grow

Receiving the best clinical care post-stroke is of utmost importance to stroke survivors and their loved ones. Our Comprehensive Stroke Management program ensures that patients and their families have access to the best clinical care based on the latest developments in research and technology. Our caring team of clinicians, nurse practitioners, and clinic staff are dedicated to partnering with patients, their loved ones, and academic researchers to develop a rehabilitation plan that will allow the individual to optimize their function.

John McGuire, MD is the Director of the clinical program, and the Co-Director of the SRC, positioning our program to integrate the latest research directly into clinical care. Faculty members Nick Ketchum, MD, Brian Robertson-Dick, MD, and Erin McGonigle, MD also staff this clinic. Drs. Robertson-Dick and McGonigle completed the SRC Stroke Fellowship in collaboration with researchers in Physical Therapy and Biomedical Engineering at Marquette University and continue to conduct research to optimize functional recovery of stroke related disability. Karin Goodfriend, MD cares for our pediatric population of stroke survivors at Children's Hospital of

"I joined the SRC Community Academic Advisory Board because I felt it was important for me to be a part of something bigger than myself. I want to make a change about how stroke information is told to people (stroke survivors and caregivers). Whatever you do, don't give up hope, your laughter, or your willingness to live because there is more for you to see and accomplish."

Andrea Zweifel, Stroke Survivor
CAAB Member

Wisconsin, which has a transition program to ease these patients into our adult program. Dr. Goodfriend also completed the SRC Stroke Fellowship, and continues to perform research as a faculty member.

With a goal to expand our comprehensive multidisciplinary stroke follow-up clinic for stroke survivors, the Department of Physical Medicine and Rehabilitation has established a weekly outpatient stroke clinic at Froedtert Hospital, including follow-up visits for stroke survivors who used inpatient services at Froedtert Hospital. Additionally, this clinic aims to serve individuals impacted by chronic stroke related symptoms desiring a second opinion for available treatment options. As a clinical component of the Stroke Rehabilitation Center, the clinic further aims to disseminate active stroke related research initiatives to this population, thereby promoting translational research opportunities paired with measurement of functional outcomes.

Increasing access to stroke rehabilitation care in the community

Froedtert Hospital and the Medical College of Wisconsin stroke related clinical programs are now also

available at Community Memorial Hospital. Effective July 1, 2018, Drs. Kusuma Rao and Brian Robertson-Dick are providing physiatrist care at CMH as part of our faculty. We expect to extend the SRC clinical footprint and related research initiatives to CMH stroke survivors this fall.



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Dr. Ketchum and Dr. McGuire see stroke survivors for their ongoing rehabilitation needs at St. Joseph's Hospital outpatient clinic. We look towards the future of integrating important research findings from our collaborative relationships into clinical care as we continue to expand our reach in Southeastern Wisconsin.

Engaging stroke survivors and their loved ones as partners in research

The SRC is dedicated to transforming the lives of people touched by stroke through our clinical care and cutting-edge research. Our Community Academic Advisory Board (CAAB) includes clinicians, academic researchers, stroke survivors, individuals who have supported a stroke survivor, and other community stakeholders who see the value and importance of stroke rehabilitation in their communities. Our CAAB, established in November 2016, meets on a bimonthly basis to identify new research projects, contribute perspective and ideas to existing research projects and guide the activities of the SRC to ensure our work is directly aligned with the needs of stroke survivors and their loved ones in Southeastern Wisconsin. To date CAAB projects have included 1) making recommendations on revisions to patient education on stroke rehabilitation, 2) designing the SRC website, 3) collaborating with a team of engineers to design wearable rehabilitation technology, and 4) developing a request for funding applications for seed funding in community-based exercise programs for stroke survivors. Our purpose is to educate, empower, and engage our community of stroke survivors and their support networks to advance stroke rehabilitation that meets the needs of these individuals. The CAAB is the only known stroke rehabilitation community-academic initiative in SE Wisconsin.

Why do you participate?

Among the CAAB members, stroke survivors cited that they were motivated to participate to "help others" and increase understanding of what types of research and clinical care is being done. Our CAAB members who have had a stroke strongly felt that they have a purpose to share their experience and knowledge to advance opportunities for other stroke survivors through their participation on the CAAB. Individuals who care or have cared for a stroke survivor identified that caregivers often "get lost, or forgotten" during the stroke rehabilitation process, and wanted to provide information and insight on how to include caregivers in a more meaningful way. Overall, stroke survivors and caregivers wanted to acknowledge barriers in stroke rehabilitation for survivors, families, and caretakers, and help create ways to better prepare them for what to expect on their rehabilitation journey. Clinicians and academic researchers were motivated to participate by an interest in learning about the lived experience of stroke survivors and their caregivers outside of the clinic – with a desire to be grounded and in touch with the "real problems" experienced by this population.



SRC Program Manager, Moriah Iverson, MS was awarded the President's Community Engagement Award – Staff from the Medical College of Wisconsin in April 2018.

What have you learned?

Stroke survivors and caregivers identified that they have learned a lot about stroke rehabilitation research through their experience of participating on the CAAB. The process of participating



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created an opportunity to be seen and heard by stroke survivor peers, clinicians, and researchers which was empowering, and created pride in being able to contribute real world value through their experience. Clinicians and academic researchers learned about unique methods such as storytelling, the importance of hearing from caregivers, and found that participation on the CAAB increased the meaning and impact of their work and broke down barriers in their patient/provider relationships.

Lessons learned

Location matters! Our CAAB initially began meeting at Froedtert Hospital, which is located on a large academic medical center campus. Stroke survivors can have mobility and health barriers. Relocating the meeting space away from the academic medical center made it much easier for our members to access parking and decreased the complexity of navigating a large medical campus. Moving the meeting location to a nonclinical space also helped ease participation during winter months, when concerns over flu made attendance at a hospital setting a barrier. Meetings were originally scheduled monthly, but were decreased to bimonthly once the group was established. Our meetings are typically 2 hours long. For other groups interested in this type of work we make the following recommendations 1) consult your members on meeting logistics that would work best for them – we hadn't thought of moving the meeting off campus initially. Consider parking and ease of access to the meeting space when planning. 2) Build in extra meeting time. When meeting members are coming from many different geographical locations and have mobility issues or difficult clinical schedules meetings can easily start late. Extending meeting times also creates space for individuals with aphasia or difficulty speaking to take their time making their voices heard.

"I am a 32-year stroke survivor. Since I was given the gift of life, I feel compelled to share and teach students about my experiences and any tips I have learned. I have also gratefully discovered the benefits of volunteering for research, which I have found to improve my own abilities. I joined this group to again share, and also learn from others."

Sue Kasten, Stroke Survivor
CAAB Member

Community Engagement – Where will we go next?

We continue to develop the request for funding proposals in community-based exercise. We are expanding our membership to include community stakeholders, with a goal of elevating stroke rehabilitation awareness and programming on a community level. We are exploring using storytelling and podcasts to increase awareness of stroke rehabilitation and give stroke survivors a platform to share their stories. Our central project for the upcoming fiscal year is to develop a series of informal educational sessions on stroke rehabilitation to be given in the community.



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We are indebted to many for the generous support of the SRC. The SRC is funded in part by the Research and Education Program Fund, a component of the Advancing a Healthier Wisconsin endowment at the Medical College of Wisconsin. Marquette University and the Medical College of Wisconsin provided support for the SRC through the Department of Biomedical Engineering. The Medical College of Wisconsin's Neuroscience Research Center and the Department of Physical Medicine and Rehabilitation provided institutional support. Froedtert Hospital has been a valuable partner as we synergize our clinical care and research capacity.

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