UNIVERSITY OF WATERLOO

Office of Innovation & Research
Grand River Hospital

# 2021: A YEAR IN REVIEW

A second year into a global pandemic has not slowed Grand River Hospital's (GRH) working relationship with the University of Waterloo (UW). A key partner in advancing the hospitals strategic directions for 2021-2025, we continue to see active engagement between our hospital community and educational partner.

The following report outlines the ongoing collaborative relationship between GRH and UW. The Office of Innovation & Research remains committed to actively nurturing partnerships and engagement that advance the hospitals strategic direction of being a partner to create a world class health system and innovating to transform healthcare delivery.

GRH and UW continue to actively engage in research studies. Six new studies were initiated during 2021, with an additional eight ongoing studies active from previous years, and three studies coming to conclusion. To support future research efforts, 11 letters of support to accompany grant funding applications were provided to various researchers. In addition, the engagement for student learning opportunities continues to grow.

Our partnership with the UW continues to be a point of pride to the institution and we continue to be pleased with the success of our collaborations.

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# PARTNERING TO CREATE A WORLD CLASS HEALTH SYSTEM

GRAND River Hospital will be an engaged partner working with our partners, patients and their families to co-develop a truly world class system to advance the health and health outcomes of people in our community. To that end, staff and clinicians at GRH have partnered with numerous researchers from the University of Waterloo to conduct research studies and clinical trials to enhance patient health outcomes.

## Use of NERV's inline device for the continuous monitoring of pH and electrical conductivity as an early diagnostic method for postoperative complications

NERv Technologies, co-founded by University of Waterloo Electrical Engineering graduates Youssef Helwa and Amr Abdelgawad, and an Accelerator Center AC Jump Start Alumni program, GRH has partnered to conduct a feasibility trial.

An anastomotic leak is a common postoperative complication following general surgery, wherein contents of the lumen of the gut seep through the site of surgery, or anastomosis. These leaks cause an increase in risk of infections, peritonitis, and septic shock, thereby increasing patient morbidity and mortality. Their occurrence also increases the chances of local recurrences in cancer patients, reducing overall survival. Hospitals must therefore provide enhanced patient monitoring, diagnostic tests, and additional treatments to monitor for anastomotic leaks which can rapidly drive up the inpatient costs of patient care.

While there is discord in the medical community regarding diagnosis and management of anastomotic leaks, one fact is clear, early diagnosis is the key to successful management of leaks. Studies have shown that current methods of diagnosis detect leaks up to three days after the onset. These delays can quickly exacerbate the patient's condition, further complicating treatment, and increasing the need for re-operations and re-hospitalization.

NERv's device can provide a simple solution that complements the current standard of care, and can potentially eliminate the delay in diagnosis of anastomotic leaks in a safe and non-invasive manner. Minimal training is required to operate the device, which is calibrated using NERv's automated calibration stations, and can be attached inline to the patient's drain in the post anesthesia care unit. The external nature of the device makes the attachment and detachment process quick and efficient, minimizing any impact on the patient. The patient is then treated according to the standard of care, while the device makes continuous fluid measurements.

## Pharmacists and physicians perspectives on a proton pump inhibitor deprescribing pathway in a chronic care hospital: A qualitative evaluation study

Gabriela Lyona Limpi, School of Pharmacy, University of Waterloo
Robyn McArthur, School of Pharmacy, University of Waterloo, and Pharmacist, Grand River Hospital

There is an abundance of evidence on deprescribing potentially inappropriate medications. Specifically, literature suggests that proton pump inhibitors (PPIs) are often prescribed without an indication or for longer durations than necessary. Such inappropriate use has been linked to an increased incidence of adverse effects. To minimize these harms, Choosing Wisely Canada recommends against maintaining or renewing chronic PPIs without an attempt to stop or reduce the therapy at least once per year for most patient.

GRH has implemented a PPI deprescribing pathway. By investigating pharmacists and physicians perspective of the PPI pathway, it is hoped to gain valuable insight on the self-perceived changes in deprescribing practice while evaluating the effectiveness of the implemented pathway. The findings from this study may have an impact on the training given to healthcare workers.

## Improving care provided through COVID-19 vaccine clinics in the Region of Waterloo

Kelly Grindrod, School of Pharmacy, University of Waterloo
Catherine Burns, Faculty of Engineering, University of Waterloo
Moses Tetui, School of Pharmacy, University of Waterloo
Vickie Murray, Regional Vaccine Distribution Lead, Grand River Hospital

This research study will undertake a quality improvement assessment of the COVID-19 vaccine program within the Region of Waterloo. Under analysis will be the effect of information sharing, quality of care provided in the clinics, and the effect of the collaborative efforts on the decision making processes and the workflow within and outside of the clinics, in order to identify opportunities to optimize the vaccine roll-out in the region.

The study will be rolled out in three phases: 1) Observations: this includes observing vaccine clinic operations, task force meetings, and vaccine confidence promotion programs; 2) Qualitative Semi-Structured Interviews: this includes clinic workers, task-force members, and community leaders; and 3) Quantitative Surveys: this includes surveys of those receiving their vaccination.

By undertaking these observation, qualitative and quantitative assessment, the Region of Waterloo will be able to optimize the experiences of the population being vaccinated and provide opportunities for enhancing that experience.

## Automatic extraction of spinopelvic parameters with machine learning and development of patient-specific models using x-ray and CT-scan images

Dr. Gemah Moammer, Spine Program Lead, Grand River Hospital
John McPhee, Department of Systems Design Engineering, University of Waterloo
Dr. Ahmed Quateen, Spine Surgery Program, Grand River Hospital

Patients experience different levels of spinopelvic problems, including spine stiffness, which can have an impact on patients undergoing hip replacement surgery. By classifying the severity of this issues, physicians could theoretically categorize patients prior to surgery in order to optimize patient outcomes.

For this research, a retrospective image review of both x-ray and CT-scan images will be undertaken to extract historical patient data with respect to spinopelvic parameters, these parameters include lumbar lordosis and sacral slope. Machine learning methods will then be used to analyze patient images, obtain anatomical landmarks and extraction of spinopelvic parameters. Developed algorithms will then be able to provide classification of patient spinopelvic stiffness.

## Addressing effective rehabilitation of post-treatment breast cancer patient functional capacity

Clarke Dickerson, Department of Kinesiology, University of Waterloo
Cristina Herrera, Department of Kinesiology, University of Waterloo
Hannah Stracey, Nurse Practitioner Oncology Program, Grand River Hospital

Oncological treatment for breast cancer increases risk of developing upper extremity disabilities, with major consequences in the soft tissue and bone of patients. Radiation is considered one of the most effective therapies for breast cancer, however its application is very aggressive, and the direct relationship between radiation and decrements in shoulder muscle strength, activation, range of motion, presence of arm lymphedema and rib fragility fracture occurrence is still not clear.

This study will undertake three main objectives: 1) to evaluate shoulder muscle activation, strength, range of motion, and the presence of arm lymphedema before and after the application of radiation therapy; 2) to evaluate if an exercise training program can compensate for possible shoulder strength decrements produced by radiation therapy; and 3) to determine how radiation exposure affects shoulder muscle strength, activation range of motion, and the presence of arm lymphedema.

The knowledge gained in this study will be useful for the development of rehabilitation protocols following radiation therapy and to overcome changes in shoulder functionality while the patient is receiving the treatment.

## Developing an in-depth understanding of patient and family engagement across care transitions

Paul Stolee, School of Public Health Sciences, University of Waterloo
Jacobi Elliott, School of Public Health Sciences, University of Waterloo
Paula Van Wyk, Department of Kinesiology, University of Windsor
Jenna Merritt, Clinical Manager Medicine, Grand River Hospital

Building on prior research, the study team will focus on the factors that facilitate or hinder patient and family engagement during care transitions. Through this study, it is hoped to gain an in-depth understanding of the current engagement practices, and how these practices align with the theoretical framework (CHOICE Framework).

Determining how to best engage older adults throughout care transitions has been specifically identified in the literature as an area of opportunity to improve overall care management for complex older adult patients. While many interventions have been implemented to reduce the adverse outcomes often associated with care transitions, successful engagement of patients and their families remains an area where further work is critically needed.

As a part of this research, interviews with patients and their family caregivers during the patients care journey, as well as the healthcare providers involved in the care transitions, will occur. Following the interview period a workshop of participants who participated in the initial interviews will be held to conduct a solution focused brainstorming session to explore new ideas, resources, and interventions to improve care transitions.

The Office of Innovation & Research was pleased to facilitate a number of collaborative discussion regarding potential future research partnerships. On behalf of the study teams, 'Letters of Support' were generated to accompany grant application processes. We look forward to hearing about application success and initiation of project work.

- Centre for Bioengineering and Biotechnology, Centre Renewal with the University of Waterloo Senate Committee, October 2021
- Helen Chen, School of Public Health Sciences, Training Program for the Appropriate use of AI in equitable and Transformative Digital Public Health, CIHR July 2021
- Mahla Poudineh, Electrical and Computer Engineering, Moving Beyond Blood Glucose with Continuous Multiplexed Hormone Measurement, CIHR March 2021 and September 2021
- Parsin Reza, Systems Design Engineering, Rapid Histology of Unprocessed Intraoperative Surgical and Diagnostic Breast Specimens, CIHR March 2021, and, Next Generation Microscope for Real-Time Biopsy Diagnosis and Cancer Margin Assessment, CIHR August 2021
- Hamid Tizhoosh, Systems Design Engineering, A World Health Organization Pilot Project for Global Digital Consultation Based on Blue Book Cancer Atlases: Designing, Developing and Validating an AI-Driven Image Search Engine for Breast Cancer Subtypes to provide Computational Second Opinions through Biopsy Matching, CIHR March 2021 and August 2021
- Roberto Guglielmi, Applied Mathematics, Assessing the Impact and Forecasting the Risk of COVID-19 for Children and Families in Canada, CIHR July 2021

# CONSULTATION, COLLABORATION, AND PARTNERSHIPS

### Magnetic Resonance Imaging (MRI):

In early 2021, GRH announced replacement of its existing MRI equipment at the hospital and in late 2021 announced approval for installation of a second MRI. Replacing older technology and adding additional equipment will enable GRH to provide increased access to our MRI for research purposes. Productive conversations where held and are ongoing between GRH Medical Imaging teams and UW Associate Vice-President, Interdisciplinary Research, to gather information related to existing researchers who utilize MRI facilities elsewhere in order to promote local utilization. It is anticipated that GRH will be able to begin providing research access to the MRI in fall of 2022.

### Donation of Medical Equipment:

A new collaborative relationship is being developed between the Biomedical Engineering team at GRH and Systems Design Engineering Assistant Professor, Nima Maftoon. There comes a point in time where equipment used in clinical practice meets its end of useful life and requires replacement. Instead of this equipment finding its end in landfills or recycling facilities, this new partnership will see broken and discarded equipment find new life as learning tools for biomedical engineering students. This partnership will see students benefit from being able to apply theory to application by giving them hands-on experience with various pieces of medical equipment. We look forward to the first donations happening in early 2022.

### INTRODUCTIONS:

The Office of Innovation & Research was pleased to facilitate a number of other introductions between University of Waterloo Researchers and GRH staff/clinicians regarding potential future research partnerships. While not formalized into specific project work at this time, we look forward to hearing about fruitful relationships:

- Ramona Bobocel, Professor, Psychology. Exploration of organizational change, including diversity, equity and inclusion.
- Anita Layton, Professor, Applied Mathematics. Exploration of medication impacts on renal health
- Nima Maftoon, Assistant Professor, Systems Design Engineering. Exploration of new devices related to the treatment of otitis media
- Plinio Morita, Associate Professor, School of Public Health Sciences. Exploration of remote patient monitoring and management

# INNOVATE AND TRANSFORM HEALTHCARE DELIVERY

GRH will leverage the collective talents and strengths of GRH, our community and our partners to innovate and accelerate the transformation of healthcare delivery by building a culture of innovation and research that encourages a spirit of curiosity, discovery, and improvement; and, positions GRH as a preferred destination for learners in order to prepare for, and inform, future health care delivery. To that end, GRH is pleased to have partnered with UW on a number of initiatives that spark the spirit of curiosity and allows students from UW to turn learning into action.

## TURNING LEARNING INTO ACTION

CREATE:
Centre for Bioengineering and Biotechnology NSERC grant for the CREATE program is the first "needs-first" graduate program in Canada, in which trainees learn to directly interact with end-users and stakeholders in the patient, medical, and biotechnology industry communities to co-discover technology problems and solutions. The program's long-term objective is to produce high-quality personnel capable of thriving in a biomedical technology career.

The CREATE program spreads its learning requirements across three key objectives: Design Training, Biomedical Commercialization, and Professional Soft Skills.

GRH was pleased to provide two lectures to the CREATE trainees this year. Kailyn Clarke, Project Coordinator, Office of Innovation & Research presented: 'Knowledge Translation: Bridging the Gap from Research to Practice'. Bonnie Camm, Executive Vice President Clinical Services, presented 'Introduction to the Interdisciplinary Environment of Hospitals'.

Fall Prevention:
While fall prevention is of high importance in healthcare, falls unfortunately still happen. If falls are unavoidable, can healthcare efforts make falls happen safely instead? The Professional Practice and Falls Prevention leaders at GRH have launched an investigation into fall safety methods.

There are a number of safety devices in the marketplace to provide protection from a fall off of a motor cycle, horse, or even a fall as a result of a stunt for a movie. At GRH, the team will explore whether these types of fall safety devices could be used within a hospital setting to provide additional safety to patients and cushion any potential falls. A safe fall not only contributes to successful recovery but also supplies patients with more peace of mind should a fall occur.

With support from CREATE, a process is underway to match a trainee with the GRH care team to conduct an environmental scan to analyze fall safety devices in the non-traditional market place (meaning not marketed for healthcare) and determine their applicability for possible use in a healthcare setting.

Cancer Rehabilitation:
Under the supervision of Professors Clarke Dickerson and Tom Willet, PhD Candidate Cristina Herrera will be the first CREATE trainee to actively engage with clinical team members at GRH to design a research project focused on addressing the effective rehabilitation of post-treatment breast cancer patient functional capacity. The CREATE student will receive mentorship on project design and implementation by a GRH Oncologist, Medical Physicist, Nurse Practitioner, and Project Coordinator to facilitate learning in all aspects of interdisciplinary hospital research. Having completed study design and received ethics clearance, patient recruitment for the study will begin in early 2022.

Patient Registration:
With implementation of the hospitals new electronic health information system, teams are now exploring new ways of delivering services to patients. Specifically, the Director of Command Centre Operations and Patient Flow and team will undertake a current and future state analysis of the patient registration model, the results of which will influence a program transformation implementation strategy to ensure accuracy, efficiency, standardization, and data quality excellence of the patient registration experience. Catherine Burns, Canada Research Chair in Human Factors in Healthcare Systems, along with two systems design engineering students will partner with GRH on this initiative.

## PROFS PRESENT...

While in-person education sessions have not yet returned due to COVID-19 restrictions, the foray into virtual education opportunities has provided the opportunity to expand participation across the organization. In the past, our in-person education sessions were hosted at the Freeport Campus, home to our complex continuing care and rehabilitation programs. As such, the offered education session were focused to these areas of care. With the transition to virtual education in 2020, the array of topics being covered has also expanded as participation is now accessible to staff and clinicians across both campuses. In addition, the use of a virtual environment has brought about a new ease of archiving the sessions for staff/clinicians to access at their leisure.

Presentations hosted in 2021 include:

- Susan Cadell, Professor, School of Social Work. 'Grief: Let's talk about it'
- James Danckert, Professor, Department of Psychology. 'Boredom: A call to action'
- Jason Au, Assistant Professor, Department of Kinesiology. 'Vector flow imaging in bifurcations: Hemodynamics in a new dimension'
- Christine Purdon, Professor, Department of Psychology. 'Why are compulsions so compelling'
- Paul Stolee, Professor, and Jacobi Elliot, School of Public Health Science. 'Coming together at the seams: engaging older patients and families across care transitions'
- Dillon Browne, Assistant Professor, Department of Psychology. 'Won't someone please think of the parents!: A multilevel examination of family stress during COVID-19'
- Heather MacDougall, Associate Professor (retired), Department of History. 'Co-operation or compulsion?: Ontario's immunization of school pupils act, 1977-2021'
- Michael Dixon, Professor, Department of Psychology. 'Player's arousal and reward signatures to loot boxes: If it looks like a duck, quacks like a duck, and walks like a duck, it's a form of gambling'

The Office of Innovation & Research would like to thank Carly Turnbull, Manager, Centre for Bioengineering & Biotechnology, and Nadine Quehl, Manager Non-Profit/Public Sector Partnerships, Office of Research, for their ongoing support to schedule speakers and prepare communication materials for these events.

# CAN HEALTH NETWORK

Grand River Hospital is proud to have been chosen as one of the Ontario edges in the CAN Health Network.

This partnership of leading Canadian medical and technology institutions will take a nationwide approach to introduce technology into the health care system.

As one of the edges, Grand River Hospital will provide a space where the most promising Canadian health-tech companies will have access to real health care environments. Here, their products will receive the support they need for widespread adoption, helping companies scale first locally, then nationally and finally internationally. The CAN Health Network will allow promising companies to work directly with health care organizations to understand their needs and commercialize health technologies to meet those needs and scale up their companies. Through this, small and medium-sized enterprises and leading start-ups will be able to work with early adopter institutions to collaboratively innovate, research, develop, and refine Canadian medical technologies to make them market-ready.

The University of Waterloo Accelerator Centre (AC) and Grand River Hospital (GRH) have launched a new, collaborative program, called the PLEXUS Medtech Program, to support companies who are ready to scale, meaning those who have solutions that have been successfully adopted in a medical environment, as well as those who are near-scale and require additional support of the innovation community in their final push to get their solutions into the Canadian market. This partnership will also help to ensure that new technologies and solutions to enhance patient care are supported to benefit local patients sooner.

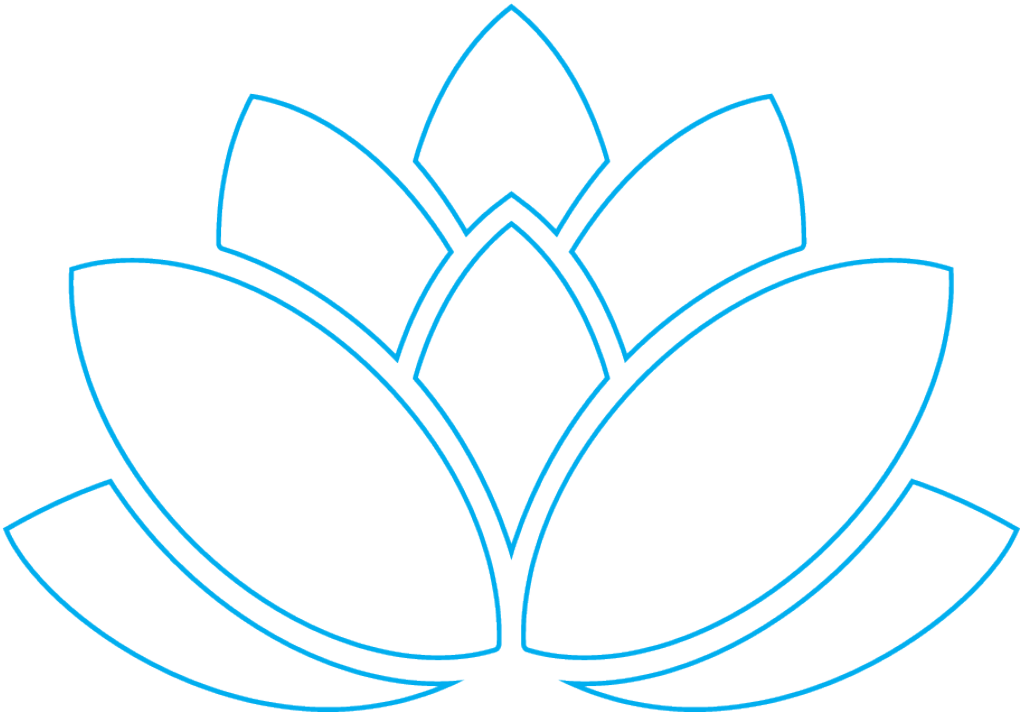
The program will combine the expertise of the hospital's Office of Innovation & Research with the AC's deep startup support system to provide researchers and clinicians the opportunity to work with entrepreneurs on ground-breaking studies that advance exceptional care, with the ultimate goal of connecting high-potential startups into the federally funded CAN Health Network's innovative procurement program.

Entrepreneurs within the program will work with the AC and GRH on a customized, short-term roadmap to build their team, navigate regulatory requirements, and prepare for consideration as a CAN Health Network project where they will gain access to staff, data, clinicians, and other resources through 3-12 month pilot projects. Startups can then move into CAN Health's innovative procurement processes with the health system to get innovative solutions adopted into the health system faster and support startups as they scale their company across Canada and globally.

CONCLUSION

It has been a wonderful year of many successes through the ongoing collaboration between Grand River Hospital and the University of Waterloo.  While the world is still poised for ongoing challenges to be faced through the COVID-19 pandemic, the dedication of our two organizations to continually foster partnerships and collaborations is a solid foundation that our organizations can take great pride in.

With enthusiasm, we eagerly look forward to all that 2022 has in store.



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