



PROGRAM OVERVIEW

# Multidisciplinary Undergraduate Research Projects in Health (MURPH)

## 2021-2022



Materials & Manufacturing  
Research Institute  
Experience Innovation with Us



Institute for Healthy Living and  
Chronic Disease Prevention  
PARTNERS IN RESEARCH FOR BETTER HEALTH



## INTRODUCTION TO MURPH

MURPH is an undergraduate research program at the University of British Columbia - Okanagan campus that aims to offer a unique cross-disciplinary platform to undergraduate students for engaging in academic research, while also providing professional training through custom-designed workshops. The core component of MURPH includes project teams comprising multiple undergraduate students and faculty members across different disciplines working together on applied (often industry driven) health research projects.

## MURPH MANAGEMENT TEAM



**Dr. Joan Bottorff**  
Professor  
School of Nursing



**Dr. Abbas Milani**  
Professor  
School of Engineering



**Dr. Harry Miller**  
Professor  
Psychology, Southern  
Medical Program



**Dr. Neil Eves**  
Associate Professor  
School of Health and  
Exercise Sciences



**Dr. Natalie Forssman**  
Lecturer  
School of Engineering



**Dr. Mahdi Takafolli**  
Research Engineer and  
MURPH Founder  
Materials and Manufacturing  
Research Institute

## MURPH GRADUATE MENTORS



**Negin Kazemian**  
PhD Candidate  
Applied Science



**Natasha Haskey**  
PhD Candidate  
Biology

*"I was able to enhance my ability to conduct research in all aspects, learn how to communicate with people from different disciplines under a professional setting, and develop on my personal organisation and teamwork skills."*

**- A MURPH Scholar**

# Multidisciplinary Undergraduate Research Projects in Health (MURPH): Structure

The MURPH program is a multidisciplinary and interdepartmental research hub at University of British Columbia Okanagan (UBCO), fostering collaborations at the edge of basic and applied research between local, national, & international research & development sectors.

## Mission

To engage undergraduate students in multidisciplinary research and offer learning objectives mainly relevant to collaborative techniques that are not typical outcomes of current undergraduate research programs at universities.

## Core Objectives

MURPH offers a unique multidisciplinary research setting along with scholarly and professional development training to undergraduates at UBCO, targeting various learning objectives including:

1. Developing skills for collaboration, scientific discussion, and brainstorming with undergraduate/graduate peers, faculty members, and collaborators from other disciplines;
1. Developing and refining research plans and protocols collaboratively; and
2. Engaging in health research activities that are meant to have meaningful impact on communities, hospitals, industries, etc.,.

## History & Success Stories

The 2021-2022 program supported 10 applied health projects encompassing 10 disciplines with a total of 17 faculty members and 21 MURPH Scholars. Below are examples of projects and achievements by students in the program (MURPH Scholars).



## MURPH Fosters Collaboration Across all Faculties



# MURPH 2021-2022 Highlights



## MURPH Launch Event (Oct 13, 2021)

Introduction to the program, management members, and funded project teams



## Workshop #1 (Nov 18, 2021)

Teamwork & Collaboration



## Workshop #2 (Jan 19, 2022)

Client Focus in Research



## Workshop #3 (Mar 2, 2022)

Research Dissemination & Presentation



## UBC Okanagan Interdisciplinary Student Health Conference (Mar 10, 2022)

## Recognitions

- MURPH funding was awarded by the Office of the Vice-President, Research and Innovation.
- MURPH inspired the launch of the Faculty of Medicine Multidisciplinary Research Program in Medicine at UBC Vancouver.
- One of the ten MURPH presentations at the 2022 virtual UBC Okanagan Interdisciplinary Student Health Conference (Kelowna) was awarded the best oral presentation in its respective category.
- One MURPH Scholar (Aidan O'Callahan) was awarded the 2021 Lieutenant Governor's medal.



2021-2022. A virtual MURPH workshop with select members in attendance

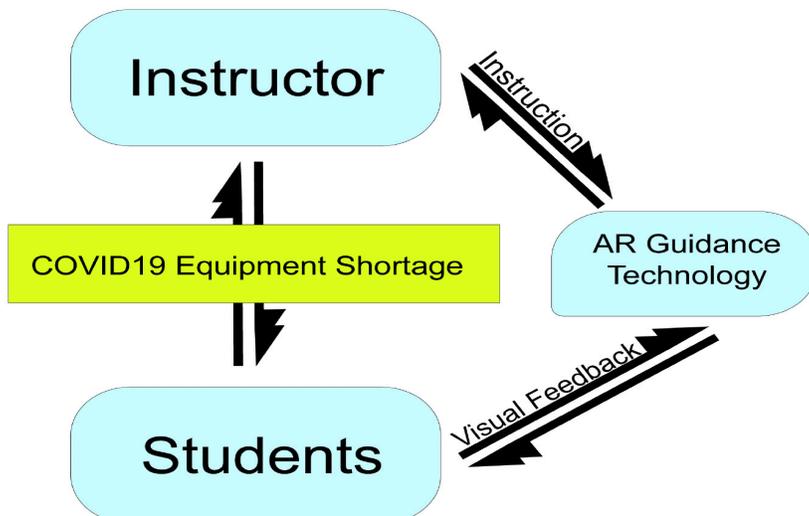
# Immersive Technology Application for Collaborative Training

## Purpose

The purpose of this research is to create a mixed reality training platform to support educators in guiding/instructing medical and nursing students. The objective is to use a mixed reality device (ex: HoloLens, Oculus) to increase interaction during teaching in order to improve the delivery of clinical content and decrease the use of physical medical supplies that are experiencing shortages due to COVID-19. Traditional training methods are limited to lectures and in-person demonstration, while mixed reality devices can enhance interaction through virtual and augmented reality and perform remote collaborative learning. The instructor can utilize this platform and device to teach the class in person or remotely, however, the platform can also allow students to practice the skills on their own time without the instructors' presence and physical supplies.

## Research Impact

With the spread of COVID-19, the use of online learning has increased exponentially, and students in the medical and nursing fields are finding it difficult to effectively learn clinical skills online, and with strict time limitations in the labs, barely enough time is allotted to practice these important skills. Our project, hopes to create an immersive technology training platform/application to not only bolster engagement in learning and enhance knowledge retention, but also provide students with an alternative method to learn where physical lab time, and instructor presence is not necessarily needed.



Due to COVID-19, medical supplies are extremely scarce due to increased demand, therefore AR guidance technology offers unique opportunities for students to practice clinical skills.



## MURPH Scholars

Vanessa Lo  
Jiyoung Jang

## Principal Investigators

School of Engineering  
Dr. Abbas Milani

School of Computer Science  
Dr. Mohammad Khalad Hasan

## Research Team Testimonial

"It is a great opportunity to be able to work with individuals outside of our discipline, collaborate together to see our project visions come to life, and mimic the work environment in a university setting."

- Vanessa & Jiyoung

# Sleep and Family Relationships Before and During the COVID-19 Pandemic

## **Purpose**

Since the start of the COVID-19 pandemic, sleep across the lifespan has worsened, with women being more adversely affected. In a study of Canadian children aged 4 to 14 years, 40% of parents reported that the COVID-19 pandemic had negatively influenced their child's sleep and 60% of parents (mainly mothers) also reported that their sleep had worsened since the start of the pandemic (Mackenzie et al. 2021). Poor sleep is associated with decreased daytime functioning in children and adults, and can negatively impact family relationships and dynamics. Thus, it is critical to understand changes in family relationships and sleep brought about by the COVID-19 pandemic. The overall objectives of this study are: (1) to describe whether the COVID-19 pandemic has influenced sleep and family relationships in Okanagan families of preschool children aged 2 to 5 years, and (2) to identify factors that might put some families at greater risk of negative outcomes.

## **Research Impact**

This study helps us understand changes in sleep brought about by the COVID-19 pandemic and the effects on family relationships, so that we are better able to develop effective interventions to reduce the long-term impacts of the COVID-19 pandemic.



Mother and child relationship.



### **MURPH Scholars**

Andrea Tam  
Tristen Ramsay

### **Principal Investigators**

Department of Psychology  
Dr. Susan Holtzman

School of Nursing  
Dr. Elizabeth Keys

### **Research Team Testimonial**

“The MURPH program is an immensely enriching experience that allows us to gain valuable research experience and expand on our teamwork skills through working with people from different disciplines.”

**- Andrea & Tristen**



### **MURPH Scholars**

Alisha Sindhu  
Dylan Rogers  
Madyson Campbell

### **Principal Investigators**

School of Nursing  
Dr. Nelly Oelke

School of Social Work  
Dr. Colin Reid

### **Research Team Testimonial**

“Working within a multidisciplinary team has greatly enhanced the quality of our project by allowing each member of our group to consider new perspectives from each other’s disciplines of study.”

**- Alisha, Dylan, & Madyson**

# Restorative Approach to Addressing Healthcare Harm: Building a Curriculum

## **Purpose**

Patient Harm in providing health services is a significant safety issue. Many efforts have been made to improve patient safety and prevent harm, however high rates of patient safety events continue to occur every minute and 18 seconds and result in 28,000 deaths/year in Canada. Healthcare harm occurs when an individual experiences harm as a result of an interaction with the healthcare system. This type of harm is most often unintentional, but when it does occur, all parties become involved in processes that ultimately do not facilitate healing. A restorative approach is a worldview encompassed by relational communication which fosters mutual understanding and healing to instill trust in the system. The purpose of this project is to develop a curriculum that teaches about a restorative approach and how it can facilitate healing for all parties involved when events of healthcare harm occur.

## **Research Impact**

Developing a curriculum to teach what a restorative approach is will help healthcare providers and patient safety experts to understand how relational communication will be beneficial to fostering an environment of healing after harm occurs. Implementation of this curriculum in various health authorities and sectors will allow this approach to be recognized and facilitate its use within the health system.



Relational healing through conversation .

# Foundations of Equitable Nursing Documentation and the Design of Healthcare Fairness Artificial Intelligence

## Purpose

Historically, various marginalized populations have had difficulties with accessing healthcare due to biases within our healthcare system. These biases often surround topics such as racism and sexism (amongst others), which cause discriminated individuals to avoid seeking healthcare in times of need. Importantly, these inequities are readily observed by community health nurses (CHNs) around BC. CHNs are also the ones who actively document healthcare information, through electronic health records (EHRs). Unfortunately, EHRs themselves are a root problem in equitable healthcare because they can be found to promote inequities in documentation. For these reasons, through interviews, we are examining how CHNs think about equitable healthcare, how they document equitable healthcare, and how the design of EHRs shape documentation. This information will then be incorporated into an artificial intelligence program to identify and prevent future inequities, thus allowing patients to feel safe to access healthcare.

## Research Impact

The development of an equitable documentation style for community health nurses will allow the identification and reduction of implicit biases through artificial intelligence. This project could encourage marginalized groups to seek healthcare where they historically may have avoided it.



Medical records are the first step to equitable healthcare..



### MURPH Scholars

Dawson Penner  
David Shifflett

### Principal Investigators

School of Nursing  
Dr. Charlene Ronquillo

School of Engineering  
Dr. Xiaoxiao Li

School of Social Work  
Dr. Shirley Chau

### Research Team Testimonial

“The multidisciplinary nature of MURPH made us realize that working with individuals from different backgrounds allows us to create a stronger project and have a greater impact on the affected communities.”

- Dawson & David



### **MURPH Scholars**

Ella Bannon  
Nadine Widjaja

### **Principal Investigators**

Department of Psychology  
Dr. Sarah Kraeutner

School of Engineering  
Dr. Vicki Komisar

### **Research Team Testimonial**

“The opportunity to become a MURPH Scholar has allowed us to apply our knowledge from the classroom and continuously learn and utilize knowledge from different disciplines in providing solutions that could be useful for the community. It also provides a space to create connections and learn to work effectively in a team.”

**- Ella & Nadine**

# Using Artificial Intelligence to Assess Performance of Fine Motor and Upper-Limb Skills in Health and Disease

## **Purpose**

About 80% of Canadians with strokes have difficulty moving their arms or legs. However, rehabilitation is often expensive and it requires the person to come into the clinic. To solve this, our research uses a new system called DeepLabCut, and a camera, to detect a person’s movement. By doing so, the person does not have to travel to a clinic because we can track their recovery progress from their own home. Additionally, the person does not need to purchase expensive machines that a clinic would use. With that, our project will help provide a cost-effective solution to monitor recovery progress for individuals with stroke from their home.

## **Research Impact**

This project is important because individuals with stroke who live far from clinics now have access to rehabilitation. Using this new system and a camera, we can track their movements from home, so individuals do not have to travel to a clinic. This should improve fairness to care for individuals with stroke.



Shifting from a complex to user-friendly motion capture for at-home rehabilitation.

# Generating Mucus Factories to Combat Intestinal Diseases

## Purpose

The microbes in our gut represent a powerful physiological force for harm or for good. Recent studies have shown that sugars called O-glycans, present in our gut's protective mucus barrier, can directly promote beneficial health-promoting microbial functions. The purpose of our research is to develop a system to produce mucus and then test its ability to decrease inflammation associated with inflammatory bowel disease (IBD) and colon cancer. Mucus has been found to promote healthy microbes to reduce inflammation, which would combat IBD and colorectal cancer. Finally, we could alter the mucus producing cells to maximize the anti-inflammatory affects.

## Research Impact

Intestinal diseases are prevalent and greatly decrease the quality of life for people with them. This research will be the first of its kind and will lead the way for possible treatments for IBD and colon cancer via mucus production. This can set the stage for commercial mucin-based therapeutics.



## MURPH Scholars

Spencer Urself  
Ojogbane Amedu

## Principal Investigators

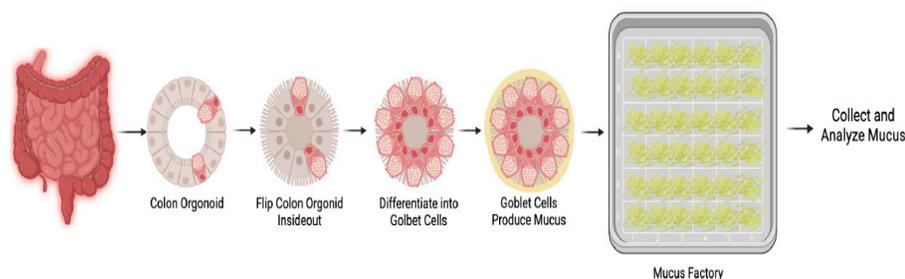
Department of Biology  
Dr. Kirk Bergstrom

Department of Chemistry  
Dr. Wesley Zandberg

## Research Team Testimonial

"Through MURPH we have gained a greater understanding of research and new appreciation for different disciplines."

- Spencer & Ojogbane



Generation of mucus factories from human colon organoids.



### MURPH Scholars

Emily Mayzes-Kotulla  
Ashish Giri

### Principal Investigators

School of Nursing  
Dr. Charlene Ronquillo

School of Nursing  
Dr. Kathy Rush

Faculty of Management  
Dr. Eric Li

### Research Team Testimonial

“The MURPH program allowed us to explore and enhance our skills while also teaching us how to operate effectively in a multidisciplinary setting.”

- Emily & Ashish

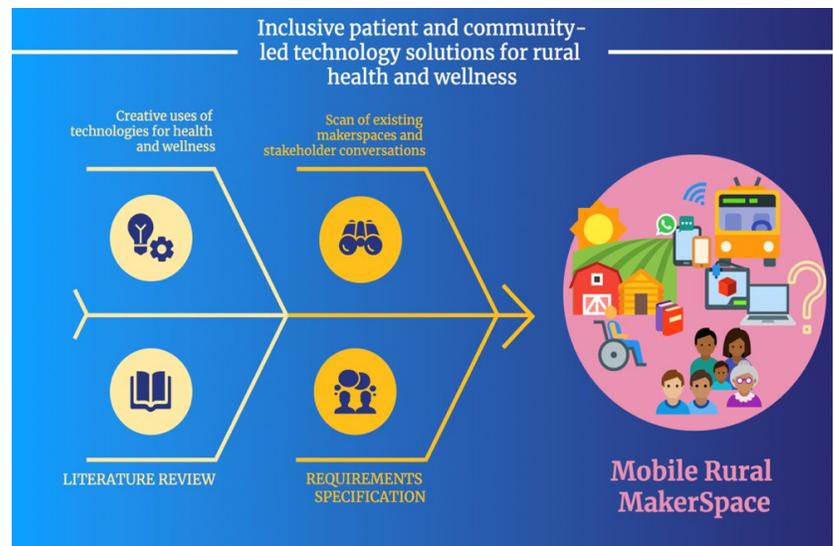
# A Mobile MakerSpace to Support Inclusive Patient and Community-led Technology Solutions for Rural Health and Wellness

## Purpose

Rural residents and health service providers have long experienced struggles in accessing affordable and inclusive health and wellness goods and services compared to their urban counterparts. Therefore, the goal of this project is to understand the health-related needs of rural BC communities, and then creating a mobile Makerspace that includes community-led technology solutions for rural health and wellness. A Makerspace is a place in which people with shared interests, especially in computing or technology, can gather to work on projects while sharing ideas, equipment, and knowledge. The goal of the proposed Makerspace is to improve access, broaden participation, support diversity, and act as an “equalizer” for people to apply and advance knowledge towards the aim of supporting health and wellness in rural communities.

## Research Impact

Over 18% of Canadians are living in rural and remote areas. But, as health and well-being challenges experienced by rural citizens require more inclusive and locally-driven solutions, this project seeks to expand the design and use of makerspaces beyond an urban lens. We hope that our proposed Makerspace will improve the health and well-being of people living in rural BC communities.



Mobile rural MakerSpace project overview.

# The 'Personal Belongings Carrier' and its Impact on Vulnerable Communities

## **Purpose**

The 'Personal Belongings Carrier' or PBC was first created in 2018 by a group of engineering students at UBC Okanagan. The goal was to create a safe and functional alternative to the shopping cart so the homeless population could store and transport their belongings with ease. Shortly after its creation, UBCO's School of Engineering partnered with the School of Social Work to prepare the PBC for the streets. Through this multidisciplinary qualitative study, we will examine the effectiveness of the PBC by gathering information on how it is viewed and used by Kelowna's homeless community. We are also exploring how the PBC could be used during evacuation events.

## **Research Impact**

One of the largest stressors for the homeless community is finding a way to safely store and transport their belongings without anything getting lost or stolen. By designing an effective belongings carrier, our hope is to eliminate this element of stress and allow homeless individuals to apply their time and energy elsewhere.



The Personal Belongings Carrier was designed by engineering students at UBCO with the intention of providing the homeless community with a safe and effective way to store and transport their belongings.



## **MURPH Scholars**

Paige Reekie  
Deniz Gunduz

## **Principal Investigators**

School of Social Work  
Dr. Shirley Chau

School of Engineering  
Dr. Abbas Milani

## **Research Team Testimonial**

"We are grateful to have the opportunity to combine our knowledge of engineering and humanities; we hope that we can use this experience to create a positive impact in the lives of the homeless community and better understand the scope of our practices."

**- Paige & Deniz**



### **MURPH Scholars**

Paige Dafoe  
Rebecca Anderson

### **Principal Investigators**

School of Nursing  
Dr. Lise Olsen

Department of Psychology  
Dr. Carolyn Szostak

### **Research Team Testimonial**

“The MURPH program has allowed us to explore previously learned topics from our degree, while expanding our knowledge through a multidisciplinary lens.”

**- Paige & Rebecca**

# **An Online Resource for Safe Active Recreation for Families Living with Autism**

## **Purpose**

Physical activity for children with neurodevelopmental disabilities (NDD) is important for their physical, psychological, and social development. Participation in recreational activity by children with autism spectrum disorder (ASD) is important for health and social inclusion. However, children with ASD and their families often experience barriers to recreation participation such as parental safety concerns surrounding active recreation (i.e., wandering and running away from family) and a lack of educational resources. In this study, we are designing a web-based parent resource to increase safety awareness in recreational settings. Results from an online survey with parents will be used to inform website design in terms of topics and format of information and resources that parents would like to see included to assist with supporting their children to engage in safe and active recreation.

## **Research Impact**

This project aims to encourage active recreation for families with ASD by providing information that will reduce the risk of harm during these activities, boost excitement and provide access to resources and support. This study will inform us of topics that interest parents and their preferences for safety information surrounding active recreation for their children. This research will help to address these concerns and encourage healthy recreation participation for families.



Family out for a walk.

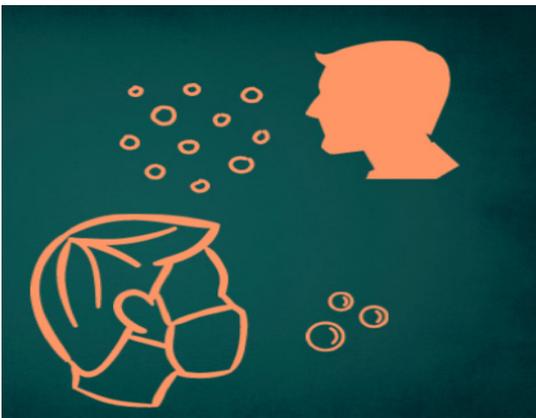
# Steps to Indoor Normalcy through COVID-19 Particle Spread Experiments

## **Purpose**

The main purpose of our research is to analyze harmful aerosol dispersion in indoor environments and test the effectiveness of mitigation strategies. To do this, harmless and traceable aerosols similar to those in question will be released in classrooms and hospital rooms, and their presence and behaviour will be measured. This simulation work will help determine how effective mitigation technology is (e.g., portable air filters) and how factors like room size, HVAC ventilation levels, viral load, and respiratory activity influence the spread of aerosols, which will ensure our data is useful for maintaining safe indoor environments for both students and patients.

## **Research Impact**

Through our experiments we aim to specify more exact protocols that should be followed in indoor spaces to ensure public and worker safety. Thanks to this specification, the way society handles pandemics could drastically change, and become not only more efficient, but also more effective, helping reduce the spread of potentially dangerous conditions.



Steps to Normalcy in indoor environments is focused on the factors that transmit aerosols, where wearing a mask is a crucial factor that can prevent COVID spread by limiting aerosol transmission.



## **MURPH Scholars**

Riya Naik  
Endrio Rambelli

## **Principal Investigators**

School of Engineering  
Dr. Sunny Li

School of Health and Exercise  
Sciences  
Dr. Jonathan Little

## **Research Team Testimonial**

“Working in a multidisciplinary research team on a relevant worldwide issue presents the chance to learn from our peers in other fields of study and hence presents a valuable opportunity for personal growth.”

**- Riya & Endrio**

# MURPH Group Posters



## A Mixed Reality Guidance Tool For Medical Training

Vanessa Lo, Jay Jang, Rohith Jayaraman Krishnamurthy, Iman Jalivand, Mohammad Khalad Hasan, Abbas Milani

### INTRODUCTION

#### Background:

- Due to the Covid-19 pandemic, students in healthcare are finding it challenging to learn practical clinical skills online
- The pandemic has led to a global scarcity of medical supplies with manufacturers prioritizing hospitals, leaving educational facilities with few supplies to utilize for training purposes
- Inspired by the recent advancements of augmented and virtual reality technology, we created a mixed reality training platform for healthcare students
- With mixed reality, physical and digital objects co-exist in a way that enables interactivity between the two



#### Objective:

- Design a mixed reality solution to train students with clinical skills where physical lab time, medical supplies and instructor presence are not necessarily required
- Determine whether our platform is effective as a supplement to physical lab time in enhancing knowledge and consolidation of clinical skills

### METHODS

1. Review of literature & current training technology
2. Mixed reality platform development
3. User study to gather feedback

### REVIEW OF LITERATURE

#### Focused review of literature included:

- Current AR and VR training platforms and barriers/limitations to implementing in training curriculum at schools
- Evaluation of current AR and VR solutions in medical and medicine training
- Review of AR and VR system implementations and methodologies

### DEVELOPMENT OF PLATFORM

- The system is made using Unity Engine, a popular game engine that supports development of Mixed-Reality applications on Head-Mounted devices such as HoloLens
- We use **Microsoft Mixed Reality Toolkit (MRTK)** in conjunction with **Photon Unity Networking (PUN)** to have connected experiences using the cloud server
- With the system, an instructor can upload assembly instructions and 3D models that are projected to the students wearing the Microsoft HoloLens
- A student can then follow the instructions provided to practice the different steps of a particular lab skill
- System allows students to advance onto the next step once previous step was completed successfully
- Platform has two ways to provide **feedback and instructions**
- Feedback Via (i) Text and (ii) Audio
- Instructions can be sent by (i) the application and (ii) the instructor



### PRELIMINARY FINDINGS & NEXT STEPS

- We will be conducting semi-structured interviews exploring students' perspective of mixed-reality training modalities and current barriers to lab learning
- We will be conducting user studies to evaluate the effectiveness of the prototype

#### Anticipated student perspectives

- Students will agree that a mixed reality training platform would be useful as a supplemental tool to consolidate learned skills
- Training platform would not completely replace in-person trainings as they are critical components in learning

#### Anticipated results of user feedback

- Find platform to be useful as it supports auditory and visual learners with option of audio or text instructions
- The repeatability and guidance will allow users easily complete the demonstrative skill
- Dexterity of system can be improved with the addition of haptic sensors for kinesthetic learners

#### Next Steps:

Interview more students to understand improvements to be made with current training modality

Collect more users' feedback to better understand usefulness and efficiency of the platform

Publish findings in academic journals to guide future mixed reality training development in the field

### CONCLUSION

- Our mixed reality training platform aims to enhance the quality of students' training experience and enable educators to make the shift to implement disruptive technology in the training of future healthcare professionals.
- This platform has potential to become a valuable tool in bridging the gap between practical and theoretical knowledge in healthcare training

Acknowledgement: The project is partially funded by UBC Excellence Fund and NSERC Discovery Grant



THE UNIVERSITY OF BRITISH COLUMBIA

## Sleep and Family Relationships Before and During the COVID-19 Pandemic: A Study of Central Okanagan Families with Preschool-aged Children

Tristen Ramsay, Andrea Tam, Elizabeth Keys, Susan Holtzman  
University of British Columbia, Okanagan Campus

### Introduction

- Since the start of the COVID-19 pandemic, the quality and duration of sleep for both children and parents worsened
- Poor sleep can negatively impact family dynamics and long-term emotional and educational outcomes for children by causing family stress, chronic tiredness, and poor mood
- Therefore, it is critical to understand changes in family relationships and sleep brought about by the COVID-19 pandemic

### Objectives

- To describe preschool children's sleep duration, and their mother's sleep quality and fatigue during the COVID-19 pandemic
- To describe changes in mother-child and mother-partner relationships during the COVID-19 pandemic
- To compare the strength of the association between sleep and mother-child and partner relationships
- To compare the strength and direction of the relationships between children's technology use and sleep in children and their parents

### Hypothesis

We expect...

- Participants in the COVID-19 cohort to report poorer sleep and lower family relationship quality compared to the pre-pandemic cohort.
- A significant association in both cohorts between sleep quality and family relationship quality.
- A stronger link between sleep quality and family relationship quality in the pandemic cohort.

### Methods

- Collect data during the current 2022 COVID-19 wave through an online survey tool (Qualtrics)
- Compare these to a pre-pandemic 2019 cross-sectional dataset
- Online questionnaire will ask about parent-child and partner relationship quality, child sleep duration, parental sleep quality and fatigue, child and parental well-being and mental health, and child and household sociodemographic characteristics
- Participants will be recruited through social media and community partners
- To analyze data, a merged de-identified dataset will be created from both cohorts using SPSS software
- Statistical tests will be conducted, including chi-square and independent samples t-tests to determine if significant differences exist between samples in sociodemographic characteristics
- Using multivariate analysis of covariance to determine if differences between the two samples exist for child sleep duration, parental sleep quality and fatigue, and family relationship quality

### Implications

- Understanding changes in sleep brought about by the COVID-19 pandemic and the effects on family relationships is crucial to developing effective interventions to reduce long-term impacts.
- Findings will:
  - Inform local programming
  - Add to the emerging evidence base on the impact of the COVID-19 pandemic on families with young children



Multidisciplinary Undergraduate Research Projects in Health (MURPH)

# Developing and evaluating an educational program for using a restorative approach to address healthcare harm

Dylan Rogers, Madyson Campbell, Alisha Sindhu, Dr. Colin Reid, Alison Koojiman, Melissa Faulkner, Dr. Nelly Oelke

## Introduction

Every 78 seconds, a patient safety incident occurs in the Canadian healthcare setting, resulting in the deaths of 28,000 Canadians a year.<sup>1</sup> Healthcare harm occurs when an individual experiences harm due to an untoward interaction with the healthcare system. This type of harm is often unintentional, but when it does occur, these events can negatively affect the patients' health and well-being.<sup>2</sup>

Current administrative approaches focus on attributing blame and punishment and ultimately the needs of patients, their families, and providers often go unmet.

A restorative approach is a worldview encompassed by relational communication which fosters mutual understanding and healing to support just relations between people, communities, and institutions. It encourages conversation and sharing of experiences related to harm, so to articulate healing needs, reconcile relationships, and determine obligations for reparations. This is a novel approach in the healthcare system that has yet to be explored.

## Objective

The purpose of this project is to develop a pilot curriculum that teaches about restorative approach (RA) and how it can facilitate healing for all agents involved when events of healthcare harm occur.

Developing a curriculum to teach what RA is will help health care providers and patient safety experts to understand how relational communication will be beneficial to fostering an environment of healing after events of harm.



THE UNIVERSITY OF BRITISH COLUMBIA  
Multidisciplinary Undergraduate Research Projects in Health

## Methods



Phase 1 of the project involved the collection of pertinent information to be included in the curriculum. As well, focus group sessions and interviews were hosted with various professionals with demonstrated interest and expertise in RA.

Phase 2 involved the development and presentation of the pilot curriculum to three sample cohorts. The curriculum consists of two 45-minute self-guided modules delivered via Canvas Catalog and two corresponding one-hour learning sessions delivered via Zoom.

Phase 3 involved the evaluation of the curriculum based on learner responses. The evaluation was a Qualtrics survey containing an amalgam of 15 open and close-ended questions which were distributed following the synchronous dimension of the curriculum.



## Introduction

The qualitative data concerned the strengths and weaknesses of the program, and fostered space to host communication as to how to facilitate the learning of others in the future. The results reflected a keen interest in further case studies, with comments such as "demonstrating an interest in moving beyond conceptual toward application."

The closed-ended, qualitative questions consisted of five responses which ranged from strongly disagreed to strongly agreed, associated with a numerical value from 1 to 5 (with 1 being strongly disagreed and 5 being strongly agreed).

Of the quantitative questions, two regarded the learner's background and their experience with RA. The following three questions concerned the learner's experience with the curriculum. The quantitative results were analyzed for the mean and standard deviation, providing insight as to how the collective responded to the curriculum's content and medium of presentation.

One question regarding the learner's knowledge following the curriculum returned a mean of 4.2 out of 5, denoting a strong confidence in the accumulated knowledge following the curriculum; a following question asked how the learner's understanding of RA improved following the curriculum, and returned a mean of 4.53 out of 5.

When asked whether they would like to receive further learning opportunities concerning the use of RA in healthcare contexts, the sample response had a mean of 4.67 out of 5, demonstrating a statistically strong interest in further learning opportunities.



## Impact and Future Work

The objective of this pilot curriculum was to provide learners with the foundational knowledge to continue lifelong learning of RA. Learners were introduced to the key facets of a RA worldview and explored an alternative means of addressing healthcare harm.

The Qualtrics survey results reflect a growing interest and engagement with RA principles within the collective involved with this pilot curriculum. Responses will be used to adapt the curriculum and guide future training opportunities on using RA in healthcare contexts. Future projects include RA facilitator training in partnership with the Canadian Justice Institute and feasibility projects in two BC health authorities.

## References

1. RiskAnalytics. (2017). The Case for Investing in Patient Safety in Canada. Paper prepared for the Canadian Patient Safety Institute. Toronto, ON: RiskAnalytics.
2. Ottosen, M. J., Sedlock, E. W., Alge, A. O., Bell, S. K., Gallagher, T. H., & Thomas, E. (2018). Long-term impacts faced by patients and families after harmful healthcare events. *Journal of Patient Safety*, 17(8), 1145-1151. <https://doi.org/10.1097/pts.0000000000000451>

## Acknowledgement

Thanks to the BC Patient Safety & Quality Council and Multidisciplinary Undergraduate Research Projects in Health for supporting this project.



# Understanding the Complexity in Clinical Documentation of Health Equity: Beginning Steps Towards Equitable AI

David Shifflett, Dawson Penner, Dr. Shirley Chau, Dr. Xiaoxiao Li, and Dr. Charlene Ronquillo



## Introduction and Objectives

A key goal in health care delivery is ensuring that everyone in a society has equal access to the same level of health care. The increased interest and use of Artificial Intelligence (AI) algorithms in health systems presents great opportunities but also risks for exacerbating existing societal biases. As the largest producers of data in communities and the profession who spend the most time with patients, community health nurses have great potential to influence future possibilities of AI in health systems, and the extent that these can incorporate either equity or bias. In particular, the nature of community health nurses' clinical documentation and the ways that concepts of health equity and social determinants of health are documented can influence the ability to consider these in the development of AI. However, we have a poor understanding of how nurses conceptualize and document the complex concept of health equity, which is further complicated by the limitations of many electronic health records systems. We address this gap by seeking to understand how community health nurses conceptualize and document health equity issues in electronic health records, as a foundational step towards developing more equitable AI.

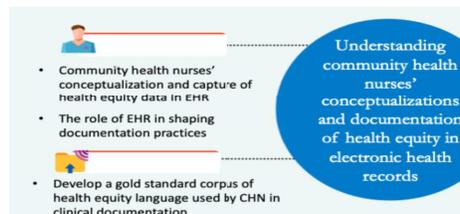


Figure 1. An overview of the first stage in this three-part project

## Results, Discussion, and Conclusion

A literature review was conducted at the intersection of health equity, electronic health records, and nursing to check for previous research. The current study has recently been approved by the Behavioural Research Ethics Board and data collection is currently underway.

## Limitations

The sampling frame of using two specific health authorities in British Columbia may limit the transferability of results. The use of convenience sampling may present a limitation in the ability to obtain diverse participants and introduce the possibility of poor representativeness of the sample.

## Future Directions

This study comprises the first in a series of studies in a larger program of research that aims to leverage rich, nurse-generated data to develop equitable artificial intelligence algorithms for health systems. Results from this study will directly inform the development of a text corpus of terms used by community health nurses to document health equity concepts in electronic health records. The text corpus will subsequently be used in future studies that will build equitable AI predictive risk models for use by community health nurses.

## Acknowledgments



THE UNIVERSITY OF BRITISH COLUMBIA  
Multidisciplinary Undergraduate Research Projects in Health

## References

1. Strauss AL, Corbin JM. *The basics of qualitative research: grounded theory procedures and techniques*. Newbury Park, CA: SAGE, 1990.

## Method

### Participants

Approximately thirty community health nurses who work in two large health authorities in British Columbia were recruited to engage in interviews and member-checking sessions. A theoretical sampling method was used to collect data while convenience and snowball sampling methods were used to recruit participants. Recruitment was conducted via advertisements on the social media pages and in the newsletters for Vancouver Coastal Health, Interior Health, the Nurse and Nurse Practitioners of BC, and the Rural Health Network of BC. Eligible participants included Registered Nurses who currently worked as community health nurses in British Columbia, who provided care in patients' homes, and who have worked in a community setting for a minimum of six months.

### Procedure

Qualitative methods informed by Corbin & Strauss' grounded theory were employed (see Figure 2). As per grounded theory approaches, constant comparison was used, wherein interviews and data analyses were done concurrently. Member-checking sessions were conducted to validate emergent themes and categories from individual interviews. Interviews and member-checking sessions were conducted and recorded via Zoom videoconferencing software and the Descript transcription service was used to transcribe interviews.

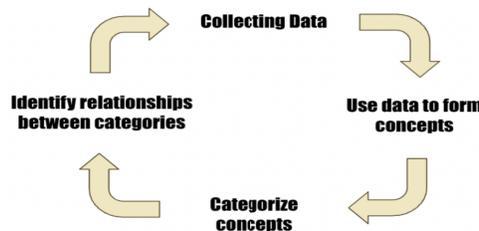


Figure 2. A simplified representation of the grounded theory approach

# Using Artificial Intelligence to assess performance of fine motor and upper-limb skills in health and disease



THE UNIVERSITY OF BRITISH COLUMBIA  
Okanagan Campus

Nadine Widjaja, Ella Bannon, Sowmya Gopalakrishnan, Parres Holliday, Vicki Komisar, PhD, Sarah N. Kraeutner, PhD

## Introduction

- Stroke recovery requires long term interventions - this is best achieved through home-based recovery programs. However, tracking and promoting motor recovery requires bulky, expensive and lab-based equipment.
- DeepLabCut is a machine learning software that can perform markerless motion capture and would allow for remote tracking of motor recovery.
- As shown in previous animal models (Lecomte et al., 2021), the main source of error while using DLC occurs when training the deep learning model using manual tagging of body parts by humans.
- Our study aims to quantify this human-based error and understand ways to correct for it. We examined the accuracy of DLC's manual tagging in tracking hand movements.

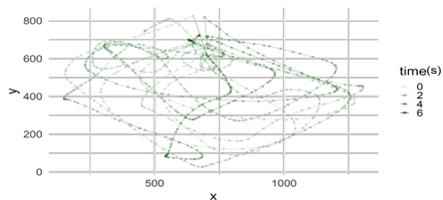
**Hypothesis:** We hypothesized that manual tagging with DLC will accurately capture the position data of a participant's hand movement compared to a touch-screen based tracker of position data.

## Methods

Here, accounting for camera angle, timing, and sampling rate, we examined the accuracy of DeepLabCut to track hand movements through the following steps:

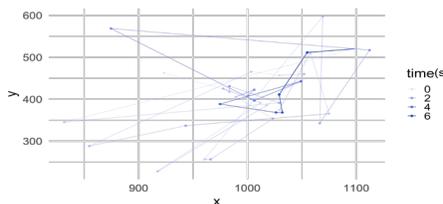
- Recorded participants' hand movements during a tracing session using a consumer-grade camera and its screen trajectories.
- Manually tagged the participants' movements.
- We obtained the x- and y-coordinates (DeepLabCut trajectories) of participants' hand movements based on the tags.
- We compared the x- and y-coordinates between the DeepLabCut trajectories and touch-screen trajectories of the participants.

## Results



Note: Participant screen trajectory

The green figure above illustrates the screen trajectory for one of the participants during the session



Note: Participant DLC trajectory

The blue figure illustrates the DLC for the same participant. After considering for timing and camera angle, the two figures show similar movement patterns.

## Discussion

- Based on the results, manually tagging participants' hands may accurately track human movements.
- However, there were a few things to note with the current study; it was challenging to extract more than 100 frames and points to replicate the screen trajectories accurately with lower sampling.
- Furthermore, we learned that the angling of the camera is crucial in ensuring that these plots follow the same trajectories.
- Nevertheless, it is essential to note that this is initial human tagging, where it is more prone to human error. There is work in progress in testing the DLC using a supercomputer to obtain more data points for more accurate DLC trajectories.

## Conclusion

- Our study acts as initial evidence in the concept of markerless motion capture.
- We identified areas to focus on for future studies, such as determining optimal sampling rate and gaining a deeper understanding of the sources of human error.
- This lays a more robust groundwork for future validation studies that explores markerless motion capture with consumer-grade equipment.

## References

Lecomte, C. G., Audet, J., Harnie, J., Frigon, A. (2021). A validation of supervised deep learning for gait analysis in the cat. *Frontiers in Neuroinformatics*, 15. <https://doi.org/10.3389/fninf.2021.712623>

## Acknowledgements

Funding: Multidisciplinary Undergraduate Research Projects in Health (MURPH)



# Differentiation of colon organoids into MUC2 secretory cells

Spencer Ussel<sup>1</sup> and Ojogbane Amedu<sup>2</sup>

<sup>1</sup>The University of British Columbia/The Irving K. Barber Faculty of Science

<sup>2</sup>The University of British Columbia/The School of Engineering

## Introduction

- Patients with intestinal diseases often have dysregulated gut microbiota and reduced floral diversity. The current potential of the gut microbiota has yet to be realized and is an active area of research. Recent studies have shown that glycoproteins in the gut are associated with anti-inflammatory interactions that could be used to treat intestinal diseases. The purpose of this research is to create a colon organoid system able to release MUC2, the glycoprotein that makes up mucus present in the colon. This research will be novel and has the potential to support the development of new treatments for inflammatory bowel disease and colon cancer. We expect these studies will lead to novel approaches to synthesize abundant functional human MUC2 as a new and commercially viable probiotic.
- To do this, the biochemical signaling pathways responsible for the differentiation of intestinal organoids can be manipulated by addition of inhibitors. We hypothesize that the addition of inhibitors DAPT, as well as IWR-1-Endo, will lead to the differentiation of human colon organoids into MUC2 secretory cell types, such as goblet cells.

## Objective

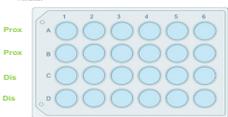
- Build on established human colon organoid culture platforms to generate an in vitro system for human colonic MUC-2 production.

## Methods

- Supplement in vitro human organoids with 75% primary culture medium (containing FBS, DMEM, antibiotics, penicillin, streptomycin, and albu) and 25% conditioned primary culture medium (containing L-WFN cells)
- Perform appropriate dilutions for each inhibitor.
- Add 500µL of diluted DAPT, IWR-1-Endo, or both, into appropriate wells as seen in Figure 1. This will block the Notch signalling pathway, and Wnt signalling pathway, respectively.
- Determine their goblet cell (mucus-producing cell) status by histologic processing.

### Plate layout for inhibition trials

Figure 1. Plate layout for inhibition trials. Rows A and B contain organoids from the proximal colon (Prox) and rows C and D contain organoids from the distal colon (Dis). DAPT was added to media in column 1, IWR-1-Endo was added to column 2, DAPT and IWR-1-Endo was added to column 3. Columns 4-6 were controls and contained normal media.

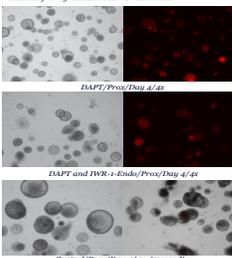


## Results

- Differentiation into goblet cells was exhibited for organoids obtained from proximal colon, when treated with DAPT, with IWR-1-Endo, or with both for 4 days. Differentiation was most abundant when proximal organoids were treated with DAPT alone, as seen in Figure 2. When proximal organoids were treated with both DAPT and IWR-1-Endo, there was more differentiation than the control but less than DAPT alone. Finally, organoids treated with IWR-1-Endo displayed little differentiation when compared to control.
- All organoids obtained from the distal colon displayed little to no differentiation when compared to the control, seen in Figure 3.

### Prox organoids treated with DAPT

Figure 2. Treatment of Prox organoids with DAPT showed the most differentiation as indicated by high presence of REDMUC2. When treated with both DAPT and IWR-1-Endo, the organoids displayed some differentiation, but less than DAPT alone. Treating organoids with IWR-1-Endo alone showed a minor amount of differentiation. All images were taken using an EVOS microscope at 4x magnification using either brightfield illumination (left) or Texas-Red filter (right) four days after inhibitors were added. Photo obtained from graduate student Rain Inaba



## Conclusion

- Differentiation into MUC2 secretory goblet type cells is possible and is most pronounced through the supplementation of DAPT to primary culture medium.

## Future Work

- By displaying that differentiation of cells into goblet cells is possible, it opens possibilities for further research in developing a clean and sustainable approach for the collection of MUC2. Future research should be directed to analysis of the anti-inflammatory effects of MUC2, and development of a collection system for MUC2.

## Reference/Bibliography

1. Bergstrom, K., Liu, X., Zhao, Y., Gao, N., Wu, Q., Song, K., Cui, Y., Li, Y., McDonald, J. M., McGee, S., Chen, W., Hryckio, M. M., Hoshino, C. W., Zelenovic, L. A., West, C. M., Chen, H., Braun, J., Fu, J., & Xia, L. (2016). Defective Intestinal Mucin-Type O-Glycosylation Causes Spontaneous Colitis-Associated Cancer in Mice. *Gastroenterology*, 151(3), 1521-1541.e11. <https://doi.org/10.1053/j.gastro.2016.02.029>

## Acknowledgement

This work was possible because of the amazing work of graduate student Rain Inaba, and honour's student Sydney Bosetti.

# Requirements Specification for a Mobile MakerSpace

Emily Mayzes-Kotulla, Ashish Giri, Dr. Charlene Ronquillo, Dr. Eric Li, Dr. Kathy Rush

## Introduction/Background

We aim to establish the conceptual and practical foundations to inform the development of a makerspace for health and wellness that will service rural British Columbia communities, with a focus on inclusive and creative technology solutions. Makerspace is defined as: "A place in which people with shared interests, especially in computing or technology, can gather to work on projects while sharing ideas, equipment, and knowledge." The goal of the eventual makerspace is to improve access, broaden participation, support diversity, and act as an "equalizer" to foster innovations in supporting health and wellness in rural communities.

## Objectives

**Study purpose:** This is an exploratory multiple case study that aims to identify and articulate the requirements to build an inclusive makerspace focused on enabling the development of health and wellness solutions in rural British Columbia communities.

The study includes the following objectives:

- To understand how existing makerspaces in cities and rural communities in British Columbia have been developed
- To understand provider experiences running and maintaining a makerspace and users' experiences of using a makerspace
- To understand how existing makerspaces assess the anticipated needs and capabilities of target user groups and use these to determine the required equipment and knowledge
- To examine the extent to which health and wellness projects have been targeted in existing makerspaces, and barriers and facilitators
- To gain insight into how makerspace users determine what counts as innovations

## Methods

To address the study objectives, we implement a two-component research design: integrated literature review and multiple case study.

### Component 1 – Integrated Literature Review

### Component 2 – Multiple Case Study

We will identify three makerspace sites in British Columbia to conduct a multiple qualitative case study. We will use purposive and snowball sampling to recruit participants from each makerspace site. All participants will be provided with an honorarium as a token of thanks for their participation. We will use thematic analysis to analyze study data.

Data we will collect in this study include:

- individual interviews
- focus groups
- document artifacts

**Study population:** We aim to recruit 10 participants for each makerspace case study site, for a total of 24-30 participants recruited across all three makerspace sites. For each makerspace site we will recruit 4 makerspace providers/organizers to participate in individual interviews and 4-6 makerspace users to participate in a focus group (4-6 participants).



### Component 2 – Multiple Case Study

We will identify three makerspace sites in British Columbia to conduct a multiple qualitative case study. We will use purposive and snowball sampling to recruit participants from each makerspace site. All participants will be provided with an honorarium as a token of thanks for their participation. We will use thematic analysis to analyze study data.

Data we will collect in this study include:

- individual interviews
- focus groups
- document artifacts



## Conclusion

Upon completion of our study, these are the things that we hope to acquire:

- necessary knowledge to build an inclusive makerspace focused on enabling the development of health and wellness solutions in rural BC communities.
- The goal of the eventual makerspace to improve access, broaden participation, support diversity, and act as an "equalizer" to foster innovations in supporting health and wellness in rural communities.



## Future Work

We hope that our work will prompt future researchers and investors to actually build a health MakerSpace and fund the project adequately respectively. We hope to see MakerSpaces being not only urban centric but also focused to rural communities.

## References

- Seaton, C. L., Rondier, P., Rush, K. L., Li, E., Plamondon, K., Pesut, B., ... & Bortoff, J. L. (2021). Community Stakeholder-Driven Technology Solutions Towards Rural Health Equity: A Concept Mapping Study

## Acknowledgement

We would like to give thanks to our supervisors, who provided guidance and support throughout this project.



THE UNIVERSITY OF BRITISH COLUMBIA

Partners

THE UNIVERSITY OF BRITISH COLUMBIA  
Multidisciplinary Undergraduate Research Projects in Health

# The 'Personal Belongings Carrier' (PBC) and Its Effect on Vulnerable Communities

Paige Reekie,<sup>1,5</sup> Deniz Gündüz,<sup>2,5</sup> Shirley Chau, Ph.D.,<sup>3,5</sup> Abbas S. Milani, Ph.D.<sup>4,5</sup>

## Background

The 'personal belongings carrier' was created by a group of engineering students at UBC Okanagan. The goal was to create a functional alternative to the shopping cart that enabled the homeless population to store/move their belongings with peace of mind (UBC Okanagan News, 2018). The PBC was recognized by the city as a device that could help facilitate independence and improve quality of life (Journey Home, 2018).

The issue of homelessness reaches far beyond a lack of housing; homeless individuals face additional barriers such as stigmatization, criminalization, and an inability to secure their property (Eisenmann and Origanti, 2021). Homeless individuals spend excessive amounts of time transporting and protecting their belongings, this can prevent them from accessing services.

During natural disasters, shelters often do not have a system in place to safely and efficiently store belongings, this makes theft a prominent issue (Choi et al., 2020). It is possible that a PBC-like device could be implemented at these shelters to increase security and promote recovery.

## Objective

This study investigates how a locally engineered 'personal belongings carrier' can be used to improve the quality of life for vulnerable communities, specifically the homeless population and natural disaster evacuees. We will receive feedback on the PBC prototype design so we can engineer a more desirable model.

## Methods

This human-centered design study can be separated into two components: prototype design and data collection.

The prototype cart was designed by a group of UBC engineering students. The cart has many features including: a lockable safe, USB solar panel, an internal power bank, a GPS system, GEO fencing, and 0.5 m<sup>3</sup> of storage. The dimensions are 27.5" in width, 29" in length, and 36.5" in height. The empty weight is 55lbs.



Figure 1. A side-view of the PBC prototype.

Interviews and consultation meetings were conducted with both Kelowna city staff and homeless community members. Participants gave feedback on the cart design; they were also asked to fill out a thirteen question questionnaire. Individual semi-structured interviews will be conducted with homeless community members in downtown Kelowna, during these interviews participants will be able to test the cart on the streets while giving design feedback. Additionally, a literature review was conducted to determine if a PBC-like device would be useful during disaster evacuations.

## Results

It was determined that the homeless community would benefit from the implementation of a PBC device, however, only with certain alterations.

Many participants suggested that those who are unwilling/unable to live in shelters would benefit most from having the PBC. To address this community specifically, it was recommended that shelter-like components such as a pull-out canvas tent or an extendable chair be included.

It was also recommended that we make the cart as personable as possible by removing the GPS system, allowing the owner to keep it with them at all times, and adding personalizable design aspects. Additionally, the cart can be more weather-proof by including sealable doors, more versatile casters, and splash guards

The literature review showed no evidence of previous PBC-like devices being used during disaster evacuations. However, there were a few areas that could benefit from a storage device including organized evacuation processes, and safe belongings security when within the shelter.

## Conclusion

It was found that both the homeless community and natural disaster evacuees could benefit from the use of a PBC device, but only if certain changes are made to the design. Before the implementation of this device, it is recommended that we add shelter-like components, such as a canvas tarp, and work to optimize personability.

## Future Work

In the coming months, we plan to continue data collection in downtown Kelowna. After sufficient data has been collected, the team of engineers will develop a new prototype that encompasses the feedback we received. Then, we hope to create a plan to distribute the PBC throughout Kelowna as well as other cities.

## References

- Choi, Y. R., Kim, E. J., & Kim, M. K. (2020). A planning guide for temporary disaster shelters focusing on habitability. *Indoor and Built Environment*, 29(10), 1412–1424. <https://doi.org/10.1177/1420326X19886051>
- Eisenmann, A., & Origanti, F. (2021). Homeless rights: A call for change. *Journal of Social Distress and Homeless, 30*(1), 90-96. <https://doi.org/10.1080/10530789.2019.1705519>
- Journey Home. (2018). *Kelowna's Journey Home Strategy Community Report* [PDF]. [https://www.journeyhome.ca/wp-content/uploads/2019/04/journey\\_home\\_community\\_report\\_web\\_version-reduced.pdf](https://www.journeyhome.ca/wp-content/uploads/2019/04/journey_home_community_report_web_version-reduced.pdf)
- UBC Okanagan News. (2018, May 16). UBC's personal belongings cart ready to hit the streets. <https://news.ok.ubc.ca/2018/05/16/ubcs-personal-belongings-cart-ready-to-hit-the-streets/>

## Acknowledgements

We acknowledge the contributions and support of many members from the community, including members of LECO, the City of Kelowna, Interior Health, and Miss JoAnne McKenzie, ACSW, Outreach Manager, Kelowna's Gospel Mission

<sup>1</sup> School of Health and Exercise Sciences; <sup>2</sup> School of Engineering; <sup>3</sup> Associate Professor, School of Social Work; <sup>4</sup> Professor, School of Engineering; <sup>5</sup> UBC Okanagan

# Developing an Online Resource for Safe Active Recreation for Families of Children with Autism Spectrum Disorder (ASD).

Anderson, R.<sup>1</sup>, Dafoe, P.<sup>1</sup>, Szostak, C.<sup>1</sup>, Olsen, L.<sup>2</sup>

<sup>1</sup>Department of Psychology, I.K. Barber School of Arts and Science, <sup>2</sup>School of Nursing, Faculty of Health and Social Development



THE UNIVERSITY OF BRITISH COLUMBIA  
Multidisciplinary Undergraduate Research Projects in Health

**Introduction**

- Physical activity for children with neurodevelopmental disabilities (NDD) is important for their physical, psychological, and social development.
- For children with autism spectrum disorder (ASD), participation in recreational activity also contributes to social inclusion and quality of life.
- Children with autism and their families experience many barriers to recreation participation.

**Research Objectives**

- This project aims to develop a web-based resource for families of children with ASD to mitigate barriers surrounding safe and active recreation.

**Methods**

- A web-based parent resource is being designed to increase safety awareness in recreational settings.
- We collected data through an online survey to incorporate parent preferences into the website.
  - To date, 5 parents and 7 service providers have responded (n=12).
- A literature review of peer-reviewed academic sources and reputable grey literature is currently being completed on safe swimming and water activities, hiking and camping.
- Academic articles are being identified through PsycInfo, CINAHL, and Google Scholar.
- Key terms: "water safety", "Autism Spectrum Disorder OR ASD", "Swimming", "Hiking", "Camping", "Outdoor recreation", "Active Play".

**References:**

- Fahy et al., (2020). Journal of Occupational Science.
- Grady-Dominguez et al., (2021). Int. J. Environ. Res. Public Health.
- Kortenkamp et al., (2017). Journal of Outdoor Recreation and Tourism.
- Lawson et al., 2019. Clinical Medicine Insights: Pediatrics.



**Results**

**Preliminary Survey Results:**

- Access to supervisors and coaches with safety-related training was rated as the most important topic to include for accessing safe environments.

**Website Design**

- Survey participants rated reliable and trustworthy information, well-organized pages, and ease of navigation between pages as the top 3 most important website features to include.

**Outdoor Activities:**

- Outdoor activities can be very beneficial for a child's development.
- Children with autism show preferences for outdoor play with sensory elements.<sup>1</sup>
- A risky or free play approach where children navigate challenging, exciting play that may include a possibility of harm may benefit children including those with autism.<sup>2</sup>

**Hiking and Camping:**

- Outdoor activity can be beneficial for children with autism but may include hazards.
  - Situations are variable and can be adapted to each child's needs.
- To mitigate risk, it is important to be prepared and plan for all scenarios.<sup>3</sup>

**Swimming and Water Safety:**

- Swimming has been found to have therapeutic, social, and physical benefits for children with autism.<sup>4</sup>
- It has been noted that swimming is the most preferred physical activity for children with autism.<sup>4</sup>
- Unintentional drowning because of elopement (running away) reported as the leading cause of death in children with ASD under 14.<sup>4</sup>
- To mitigate these risks, autism-specific swimming lessons have been found to be effective, as well as using individualized modifications for safety while around the water.

**Parent and Service Provider Ratings of Safety Topics**

Safety Topic	Mean Rating of Importance (0-5)
Swimming and Water Safety	4.5
Traffic/Pedestrian Safety	4.4
Safe play with other Children	4.3
Interacting Safety with Adults	4.2
Cycling Safety	4.1

**Example Web Page**

**Swimming and Water Safety**

**Benefits**

- Swimming has been found to have therapeutic, social, and physical benefits for children with autism.

**Risks**

- Unintentional drowning because of elopement (running away) reported as the leading cause of death in children with ASD under 14.

**Effective Swimming Lessons**

- Autism-specific swimming lessons have been found to be effective, as well as using individualized modifications for safety while around the water.

**Safety in the Community and Family**

- Children with autism show preferences for outdoor play with sensory elements.

**Implications**

- This project aims to encourage active recreation for families of children with autism by providing information to reduce safety concerns, reduce the risks of harm during activities, boost excitement and provide access to resources and support.
- The survey results will inform us of topics that interest parents and their preferences for safety information surrounding active recreation for their children.
- Future research will explore other topics related to active recreation for families with ASD such as pedestrian safety, safe play with other children and interacting safety with adults

**Acknowledgements**

- We would like to thank the Multidisciplinary Undergraduate Research Projects in Health (MURPH) Program and the Social Sciences and Humanities Research Council (SSHRC) for their much appreciated support of this project.

Airborne Disease Transmission Cluster

# Indoor Harmful Aerosol Mitigation Strategies

Endrio Rambelli, Riya Naik

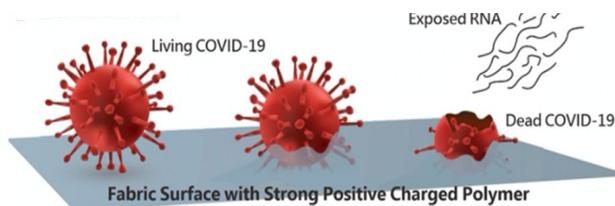
## Introduction

Our research aims to mitigate infectious COVID-19 aerosol transmission in an indoor environment. A procedure has been developed to study the electrostatic attraction between the negatively charged COVID-19 viral surface and a novel positively charged material called C-Polar. To quantify this, a qPCR protocol was developed to detect the amounts of simulated DNA gathered on the C-Polar, and a material characterization study was conducted. C-polar aims to eventually be installed indoors in the form of hospital curtains or classroom blinds.

## Protocol

To characterize the electrostatic attractive force of the fabric, a plastic microbead aerosol simulating an airborne virus was released in proximity to the material, and the amount of particles attracted to the fabric, as well as the fabric's charge were measured using a particle counter and electrometer.

The qPCR protocol was developed to quantify the aerosol biological particles captured by C-Polar. A non-coding DNA template was developed and is used to perform serial dilutions for obtaining a standard curve. SYBR green was used along with the primer for this project that tracks the dsDNA amplification in 40 cycles.



## Future work

The future of this project depends upon the data received from the upcoming tests. If the qPCR and particle counter data results show a promising attractive force present on the C-Polar material, we will be closer to proving the effectiveness of the material for installation in hospital rooms and classrooms, and refined tests will be performed on the material to prove its effectiveness in busy indoor environments.

## Acknowledgements:

Airborne Disease Transmission Research Cluster  
Jake Winkler, Sara McCreary, Dr.Sunny Li, Dr. Jon Little



THE UNIVERSITY OF BRITISH COLUMBIA

# Benefits of Collaborating with MURPH

We have developed a variety of opportunities to meet each industry partner and sponsor's objectives and needs. Your contribution will greatly strengthen our capacity to deliver high quality programming and allow for the expansion of the MURPH program to train more undergraduate students in our community.

## **1. Increase your visibility within the community**

Feature your logo on the MURPH website, as well as its events as a sponsor of the program.

## **2. Be a guest speaker**

Become a guest speaker at our upcoming MURPH events and workshops.

## **3. Collaborate with UBC laboratories**

Work with a globally respected university and faculty members and gain access to state-of-the-art research facilities.

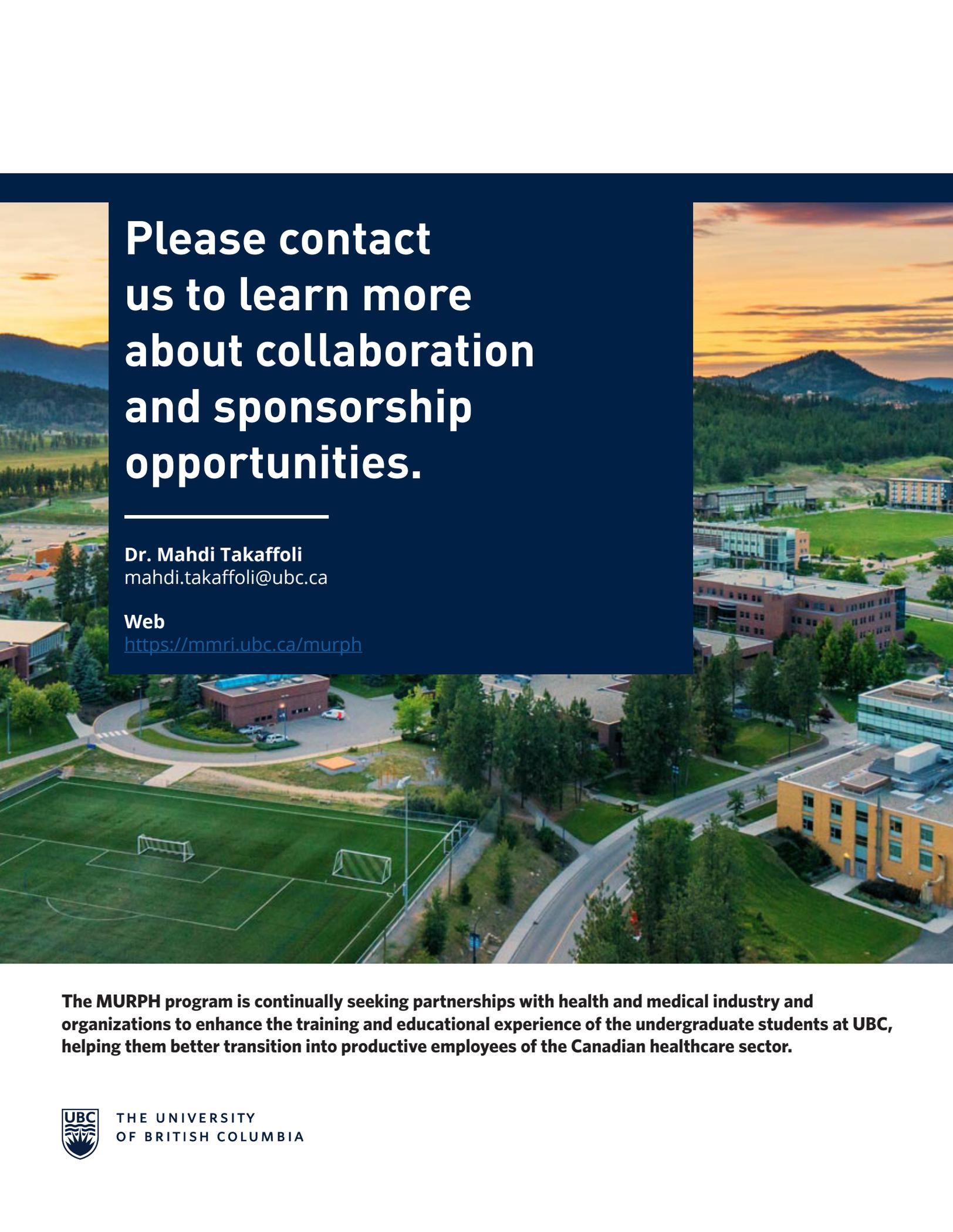
## **4. Receive research support**

Submit your project proposal to conduct multidisciplinary research projects by students under your membership for each academic year.

## **5. Build world-class talent**

Aid in the training of students and prospective employees by equipping them with job-ready skills.





**Please contact  
us to learn more  
about collaboration  
and sponsorship  
opportunities.**

---

**Dr. Mahdi Takaffoli**  
mahdi.takaffoli@ubc.ca

**Web**

<https://mmri.ubc.ca/murph>

**The MURPH program is continually seeking partnerships with health and medical industry and organizations to enhance the training and educational experience of the undergraduate students at UBC, helping them better transition into productive employees of the Canadian healthcare sector.**



THE UNIVERSITY  
OF BRITISH COLUMBIA