TRANSFORM HF
Digital Innovation for Heart Failure Care

Undergraduate Summer Research Program
Summer 2026 Projects

The TRANSFORM HF Undergraduate Summer Research Program (USRP) gives students the opportunity to train alongside our multidisciplinary community of researchers to help address the grand challenge of inequity in heart failure care.

Students participating in the USRP will receive an award of up to $6,000, which must be supplemented by a $2,000 contribution from their research supervisors to ensure a minimum total stipend of $8,000 for a period of 16 weeks.

To be eligible, students must be registered at a Canadian academic institution as a full or part-time undergraduate student at the time of application. Up to two USRP awards are reserved for Indigenous students.

To apply, students must secure a University of Toronto faculty supervisor who is a member of TRANSFORM HF. They must then work with them to complete and submit an application. To facilitate this process, students may either:

- Consult the following list of established projects seeking an undergraduate summer student, and reach out to the associated supervisor for more information.

  OR

- Consult a list of faculty within the TRANSFORM HF network, and reach out to faculty members directly to inquire about potential projects.

If students wish to work with a supervisor who is *not* already a TRANSFORM HF member, the supervisor must join the network in order for the student to apply for this opportunity.

Applications are due Sunday, March 1, 2026 at 11:59pm EST

1. MAPPING CARDIOLOGY MODEL OF CARE SERVICE BLUEPRINT WITH AI AND WEARABLE TECHNOLOGY TO IMPROVE SERVICE EXPERIENCE

Placement Duration
May 1, 2026 – August 30, 2026

Placement Location
Peter Munk Cardiac Centre, Toronto General Hospital

Project Description
This hospital-based summer studentship will engage 1–2 students in an applied human factors and health systems research project focused on improving the service experience within the UHN/Sinai Division of Cardiology. Students will apply human-centred design and service design methodologies to map existing models of care using serv ts, i orme by direct ob rvation, cont y, in nd eme ing digital too inclu ng generati AI and wea le technology.

Thro gh immersive adow ng in inpatie and ambula ry cardiology p grams, stud ts will develo a de understand g of patient, caregiver, and cl cian expe ences across e ca continuum. he project ai s to identify sys m gaps, wor ow inefficienc s, an experiential ain points, ar to generate ac nable, stak holder-informe reco ns ce whi seamlessly into real-world clinical workflows.

By the end of the placement, students will be able to:

- Apply human factors and human-centred design principles in complex healthcare environments.
- Map models of care using service blueprints that integrate people, processes, technologies, and environments.
- Conduct contextual inquiry, observational research, and semi-structured interviews with multiple healthcare stakeholders.
- Identify system-level gaps, safety risks, and inefficiencies within inpatient and ambulatory cardiology services.
- Evaluate the potential role of generative AI and wearable technologies in enhancing service design and care delivery.
- Translate qualitative insights into practical, implementable recommendations for healthcare improvement.

Stud will be exp cted contribute t and/or comp

- Detailed serv e blu rints of sele ed UHN/Sin Division of Car logy ca pathways.
- esize map patient, car iver, and cli ys h lighting pa points and op rtun areas.
- A gap analys iden ying workflo communica n, and system- vel challenges.
- A set of evidence-informed, human-centred recommendations to improve the service experience across stakeholders.
- A final written report suitable for internal quality improvement or innovation review.

- A formal oral or poster presentation to clinical, operational, and academic stakeholders.

Requirements

- Background:
  - Undergraduate or early graduate students in health sciences, biomedical engineering, industrial engineering, human factors, design, public health, computer science, or related disciplines.
  - Strong interest in healthcare delivery, patient experience, systems improvement, or digital health.
- Skills and Attributes:
  - Curiosity and comfort working in complex clinical environments.
  - Strong qualitative research skills or interest in observational and interview-based methods.
  - Ability to synthesize complex information into clear visual and written outputs.
  - Experience or interest in design thinking, service design, or quality improvement is an asset but not required.
- Other Requirements:
  - Willingness to complete hospital onboarding, confidentiality, and research ethics training.
  - Availability for clinical shadowing in both inpatient and ambulatory cardiology settings.

Contact Information

[redacted]

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2. EQUITABLE REMOTE PATIENT MONITORING FOR OLDER ADULTS

Placement Duration

May 1, 2026 – August 21, 2026

Placement Location

Institute for Better Health, Trillium Health Partners

Project Description

Canada's older adult population (65+ years) is expected to grow to 10.4 million by 2037, impacting the organization and delivery of health and social services. Remote patient monitoring (RPM) offers an approach to digitally enabled aging-in-place (AgeTech) care by allowing providers to track and monitor patient symptoms from a distance. This can be particularly useful for older adults with multiple chronic conditions. However, access to and adoption of RPM among older adults remains inequitable, as those who are unfamiliar with technology, live in rural or remote communities, or speak English as a second language, often encounter barriers that limit their participation in these programs.

To inform more equitable RPM design and implementation, there is a need to better understand the nature and extent of digital health inclusion among older adults. This project will generate evidence to support the development of RPM programs that are accessible, culturally appropriate, and responsive to the diverse needs of older adults across Ontario. Using a mixed methods approach, this project has three aims one of which is to co-design an equity-promoting conceptual model for RPM that reflects the needs of older adults and perspectives of key stakeholders. This will be the focus of the TRANSFORM HF Summer Trainee scope of work. Findings from the study will inform the equitable scaling and implementation of RPM for older adults across Ontario.

Requirements

- Education:
  - Pursuing degree (3rd or 4th year) in health sciences, public health, social sciences, gerontology, sciences or related field
  - Coursework or interested in health equity, aging, digital health, or health systems research
- Experience/Skills:
  - Some level of experience with data collection, such as surveys, interviews, or focus groups (academic, volunteer or paid)
  - Strong written and verbal communication skills, including professional email correspondence, note-taking, summarizing findings and reflection, formal report writing
  - Experience or interest in engaging with older adults particularly those from rural communities, newcomers, linguistically and ethnically diverse
  - Strong organizational skills and attention to detail
  - Comfort with using Microsoft Office Suite (teams, word, excel, powerpoint)
  - Willingness to learn, take initiative, and work collaboratively in a research team environment
  - Understanding of and sensitivity to equity, diversity, and inclusion principles and practices
- Additional assets:
  - Not required but an asset if can speak one or more of the following: Mandarin, Cantonese, Punjabi, Urdu, Hindi, or French
  - Preference for an individual who can be physically present (in Mississauga) for in-person meetings and co-design sessions

Contact Information

For more information and to express interest, please contact Isabelle Choon (Research Associate) at isabelle.choon@thp.ca.

3. HEART FAILURE PREVENTION AND CARE IN VULNERABLY HOUSED POPULATIONS

Placement Duration
May 19, 2026 to September 8, 2026

Placement Location
Sinai Health, Geriatrics

Project Description
The project will explore how heart failure and related cardiovascular risk factors, such as hypertension and diabetes, are experienced and managed by individuals who are unhoused or precariously housed, as well as the system-level challenges faced by those who support them. Using semi-structured interviews or focus groups, the student will first work with individuals with lived experience to understand barriers to prevention, diagnosis, and ongoing care, including access to medications, continuity of care, competing priorities, and the impact of housing instability on cardiovascular health. This component will build on interviews already being conducted as part of the existing program of research, allowing the student to meaningfully contribute to data collection over the summer while learning qualitative methods in a real-world, equity-focused context.

In parallel, the student will lead a complementary set of interviews with frontline workers, including shelter staff, nurses, and outreach clinicians, to examine systemic and organizational challenges in supporting cardiovascular health in homeless and precariously housed populations. These interviews will focus on care coordination, resource constraints, role boundaries, and opportunities for more integrated and prevention-oriented approaches. The goal is for the student to take primary responsibility for this frontline worker component, with the intention of developing it into a standalone manuscript, while situating the findings alongside the lived-experience data to inform more equitable and feasible heart failure prevention and care strategies.

Requirements
- Currently enrolled in an undergraduate or graduate program in health sciences, public health, social sciences, nursing, medicine, or a related field
  Coursework or demonstrated interest in qualitative research methods, health equity, or community-based research
  Strong communication skills and comfort engaging respectfully with individuals from diverse backgrounds, including people with lived experience of homelessness or precarious housing
- Ability to work independently and as part of a research team, with strong organizational and time-management skills
- Experience or interest in working with vulnerable or marginalized populations is required; prior experience in shelters, community health settings, or outreach is an asset

Contact Information
[redacted]

4. SMART TEXTILES FOR HEALTH AND PERFORMANCE MONITORING

Placement Duration
16 weeks from May to August 2026

Placement Location
University Health Network, KITE-Toronto Rehabilitation Institute

Project Description
This project focuses on evaluating non-invasive smart garments designed to monitor physiological changes during physical activity. These wearable devices use textile-integrated sensors to track temperature variations across different parts of the body. Key tasks include assisting with exercise-based data collection sessions, testing sensor performance against standard medical references, and processing data to ensure accuracy and reliability. This research aims to improve safety and health monitoring for individuals in demanding environments.

Requirements
- Current undergraduate student in biomedical engineering, electrical engineering, computer science, kinesiology or a related field.
- Interest in working with wearable smart textiles.
- Basic understanding of data collection and an ability to interact professionally with research participants.
- Experience with Python and/or MATLAB for data analysis.
- Experience with signal processing.
- Strong communication skills and high attention to detail for recording research data.

Contact Information
For more information and to express interest, please contact Dr. Saiful Hoque at saiful.hoque@utoronto.ca

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5. ALGORITHM DEVELOPMENT ASSISTANT

FILLED

Placement Duration
May 1, 2026 to August 30, 2026

Placement Location
This is a hybrid role and would require travel to Mount Sinai Hospital on an as-needed basis. However, most of the work will be conducted remotely.

Project Description
One in four heart failure (HF) patients admitted to hospitals dies within one year. Patients are instructed to monitor their condition at home after returning home from the hospital, but this strategy has been marginally successful due to patients not keeping up with the frequency of the measurements and interpreting the results. At the Cardiac Catheterization Research Laboratory (CCRL) at Mount Sinai Hospital, we are testing

SmartTile, an unobtrusive and autonomous care solution that monitors the patient during sleep without wearable or any contact with the body. The core technology tested is a bio-signal known as a ballistocardiograph (BCG). Our clinical collaborator, Dr. Susanna Mak, is a renowned HF physician, and the research team will work as part of Dr. [redacted] laboratory. The scientific advisor of the project is Dr. [redacted] Mih[redacted].

The position will involve active participation in ongoing BCG research. A successful candidate will support the supervisor, Dr. Isaac Chang, and will assist in the analysis of BCG via signal processing and algorithm development. The intern will work with Dr. Chang to process the data collected from human participants and will assist in developing signal processing and, potentially, machine learning algorithms.

Position Responsibilities:

- Assist the primary project lead, Dr. Isaac Chang, in analyzing physiological data using Python libraries, including but not limited to Numpy, Pandas, Scipy, Scikit-learn and Matplotlib. Primary development will be done in a collaborative environment.
- Clean acquired data for analysis via filtering and resampling
- Contribute to statistical analysis and machine learning algorithm development
- Optimization of written codes and modularization into functions
- Administrative and logistic tasks involved in research, including but not limited to the documentation of research protocol, literature review, and write-up of manuscript sections for publication.
- Participate in a weekly meeting with the supervisor
- Prepare reports and presentations based on the work done

Requirements

- Must have an engineering or computer science background
- Experience working with Python libraries: knowledge of Numpy, Pandas, Scipy or Scikit-learn, and Matplotlib is required
- Knowledge of basic statistical tests is required
- Basic knowledge of machine learning algorithms such as logistic regression, basic neural networks, and an understanding of supervised/unsupervised models is not required but helpful
- Strong team collaboration
- Strong problem-solving skills in the context of solving algorithmic problems
- Strong oral and written communication skills and interpersonal skills

Contact Information

[redacted]

6. VALIDATION OF AI-DRIVEN VIRTUAL REHABILITATION ASSISTANT (AVA) TO ASSESS EXERCISE ACCURACY IN VIRTUAL CARDIAC REHABILITATION

Placement Duration

May 4, 2026 to August 30, 2026

Placement Location

KITE Research Institute, Toronto Rehabilitation Institute

Project Description

Patients with heart failure often have reduced exercise capacity due to impaired heart function. Cardiac rehabilitation is a personalized standard of care program comprising supervised exercise, education and counselling aimed at restoring function, promoting healthy lifestyles and improving patient quality of life. Virtual Cardiac Rehabilitation (VCR) programs offer at-home cardiac rehabilitation services that match the efficacy of traditional in-person programs. VCR has the potential to reduce the high dropout rates seen in in-person programs due to barriers, such as transportation, financial situations and staff shortages. However, for VCR platforms to be successful, automation is essential to enable patients to perform exercises at home without continuous supervision from clinicians. We have developed an **A**I-driven **V**irtual rehabilitation **A**ssistant (AVA), a cloud-based intelligent avatar that works on any smart device with a webcam and can be accessed through a web browser. AVA monitors the body-joint movements of patients performing resistance training exercises in real time and evaluates correct exercise technique using advanced deep learning models (e.g., spatiotemporal graph convolutional networks).

Recently, advancements in large language models have offered possibilities to provide generative textual (and audio) outputs from these models. Pre-trained large language models have recently been integrated into AVA. Patients' movements are translated into action tokens and paired with the output of the deep neural networks. This information has been entered into large language models that have been fine-tuned for VCR, which will enable them to generate real-time textual and audio feedback on patients' performance with their exercises. This guidance is delivered through an animated avatar, which will instruct the patients on movement adjustments for improved safety and health outcomes during resistance training. The purpose of this project is to collect data from cardiac patients, then test the developed AI algorithms to measure exercise techniques and quality in prescribed resistance-training exercises in patients enrolled in CR. The effectiveness of AVA in delivering accurate feedback to patients will be validated through recruitment of heart failure patients at the Cardiovascular Prevention & Rehabilitation Program at UHN-Toronto Rehabilitation Institute. We expect that such interactive and engaging feedback will encourage safe and self-managed exercise at home, improve adherence to VCR programs, and boost patients' health outcomes.

Requirements

Candidates for this role must be students in computer science, electrical engineering, biomedical engineering, or a similar discipline, with experience in applying deep learning algorithms to human activity recognition, including graph convolutional networks and Transformers, and proficiency in fine-tuning large language models. The

selected student's primary duty will involve recruitment and testing of the models during resistance training exercise with patients in CR.

Contact Information
For more information and to express interest, please contact Dr. Tracey Colella at Tracey.Colella@uhn.ca

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7. ECG-to-rPPG Synthesis for Improved Abnormal Heart Rate Monitoring

Placement Duration
May 4, 2026 to August 21, 2026

Placement Location
KITE, University Health Network

Project Description
This project addresses the critical data crisis in remote photoplethysmography (rPPG) by developing a deep learning framework to synthesize abnormal heart rate patterns from electrocardiogram (ECG) data. The rPPG offers a non-contact method for monitoring vitals through facial video and can be used to extract heart rate and its variability that can indicate potential cardiac problems. However, current AI models are trained primarily on healthy individuals because capturing video of patients during acute cardiac events is logistically and ethically challenging. Therefore, these AI models cannot accurately predict abnormal heart rate or major deviations from normal. As a result, the real use of rPPG for remote monitoring of cardiac patients is largely restricted in cardiac population.

We collected rPPG and ECG dataset of 35 diverse participants across various physical states (sitting, standing, and walking). The project aims to learn a robust mapping between gold-standard ECG signals and their corresponding rPPG signals. Once this mapping is established, the project will utilize publicly available repositories of abnormal ECGs (containing arrhythmias and other cardiac irregularities) and translate them into synthetic rPPG signals. This synthetic data will serve as a high-fidelity proxy to train and refine regression models for predicting abnormal heart rate its variability. This has the potential to remove the need for patients to wear restrictive chest straps or wired sensors at home, providing a step closer to non-invasive and accessible way to monitor high-risk individuals in their natural environment.

Requirements
The ideal candidate should be an undergraduate student in computer science, electrical or biomedical engineering. Proficiency in Python and PyTorch with architectures suited for time-series translation such as Generative Adversarial Networks, Long Short-Term Memory networks, or Transformers.

Contact Information
For more information and to express interest, please contact Dr. Shehroz Khan at shehroz.khan@uhn.ca.