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It is with great pleasure that we share the Canadian VIGOUR Centre (CVC) 2020 annual report, which showcases our work around Bridging the Gap. We focus on building connections between clinical trials and population health, and traditional and artificial intelligence/machine learning methodologies, while always maintaining our focus on the patient experience. Although COVID-19 kept us apart physically, we saw the best from both people and science when collaboration occurred, bridging the need for quality research and timely delivery of science.

As we reflect upon this turbulent year, as well as the projects, colleagues, and patients who participated in the work undertaken together, there is no doubt this was a challenge for everyone involved. That said, we learned valuable lessons that will alter how we go forward.

The theme of the annual report is visually reflected by a bridge, which is an apt metaphor for much of what we do as a team. We bridge the gap between interventional and observational studies, as is evident by the teams working on population health data ("real-world evidence"), exemplified by Dr. Roopinder Sandhu, whose work describes what happens to patients with atrial fibrillation and syncope in health care settings outside of a clinical trial. More work is needed to understand how we can further bridge this gap for patients. Conversely, the VICTORIA trial was published and presented by Dr. Paul W. Armstrong, filling an observed gap in the care of patients with heart failure with an intervention that worked to reduce hospitalizations.

As the first months of 2020 were spent as per usual, the latter part of the year was spent bringing home and work life (which for many, became one and the same), and helping each other in ongoing projects. With Karen Mellor’s steady oversight and guidance, we have realized the value in investing in IT infrastructure as we transitioned seamlessly to work from home. Creative solutions have carried the day and allowed us to shed less useful practices built up over the years, get back to the core of how we best communicate and collaborate, ensure that we remain human and empathetic, and that quality science remains at the forefront.

Clinical trial sites and our creative and talented operations team worked together to carry on with flexibility, grace, and empathy as to the local situations during the pandemic. This was a time for problem solving, so that the many years of work leading to milestones, such as the first patient recruited in a trial, were not lost. This was essential, as patients still have the underlying cardiovascular diseases we closely study, and altering future patient outcomes is what we at the CVC strive for. Our clinical operations team, led by Tracy Temple, even started some new projects amongst this chaos, such as the EMPACT-MI trial, led by the CVC and our colleagues at the Duke Clinical Research Institute, and the MOIST study, a Canadian Institutes of Health Research (CIHR) funded project looking at the effects of SARS-CoV-2 on the heart via imaging and biomarkers.

The need for high-quality science remains paramount, and bridging across disciplines became immediately apparent and necessary. Work by Dr. Sean van Diepen on critical care outcomes in patients with shock was made possible by working with epidemiology, critical care, and cardiovascular medicine, through high-fidelity Canadian and global data. Under the leadership of Dr. Finlay McAlister, the CIHR-funded CORONA collaboration with our colleagues in Ontario examined the impact of COVID-19 on patient outcomes in the two provinces. Science is about data – hence our continued focus on data science. The research group, led by Dr. Cindy Westerhout, deepened our understanding and application of data science, including machine learning amongst many other standard techniques.

The CVC’s heritage was founded on research in acute coronary syndromes (ACS) and coronary artery diseases (CAD), and has continued with work by Drs. Kevin Baine and Robert Welsh focused on revascularization in CAD. This was further advanced with a focus on sex differences and the outcomes of heart failure after ACS, exploring trends in care over many decades. The link of CAD to lipids, peripheral arterial, and aortic diseases has been further championed by Dr. Sean McMurtry and the CVC team.

Finally, as the risk for ACS begins even before birth and during pregnancy, much work has focused on this period for primary and primordial prevention.

The CVC serves as a bridge between science, the University of Alberta, and the health system (Alberta Health Services). Both of these partners are undergoing substantial renovations and we have, and will continue to, adapt and lead by example to ensure a healthy future for our patients and partners.

Our team at the CVC encourages a review of our work and accomplishments highlighted in this annual report. Particularly, in the face of the extraordinary challenges 2020 has brought, it is our continued hope to collaborate broadly with scientists, clinicians, health systems, and our patient partners in generating, translating, and disseminating knowledge in cardiovascular medicine.

The CVC Co-Directors,

Justin Ezekowitz, MBBCh, MSc
Shaun Goodman, MD, MSc
Padma Kaul, PhD
The Canadian VIGOUR Centre (CVC) was established in 1997 as an academic research organization (ARO) at the University of Alberta, and has since been committed to the enhancement of cardiovascular health.

The CVC is recognized for its pioneering research in cardiovascular medicine, which embraces the translation of research through thought leadership and management of innovative clinical trials. Furthermore, the CVC is focused on the generation of new knowledge from patient registries and population outcome studies, which inform the direction of future pathways.

As an ARO, the CVC is committed to the scholarly value of scientific inquiry and truth, and believes knowledge should be shared openly in an ethical research environment. The CVC’s dedication to lifelong learning has also inspired one of our central tenets – engaging the next generation of health professionals in a research culture that embraces curiosity, welcomes new ideas, and seeks to address key unanswered questions in health care.
VISION
Generate, translate, and disseminate knowledge on novel diagnostic and therapeutic strategies in cardiovascular medicine acquired through collaborative research to enhance the health of the citizens of Alberta, Canada, and the world.

MISSION
Aligned with the University of Alberta and the Mazankowski Alberta Heart Institute, our mission is to:

- Design, conduct, analyze, and disseminate findings arising from novel clinical research.
- Interrogate clinical trial, registry, and population health data to evaluate outcomes, identify unmet needs, and inform future basic and clinical research directions.
- Identify, inspire, and nurture the next generation of health researchers and professionals.

QUALITY
Aspire to the highest standard of work while respecting a balanced life perspective. Attract, mentor, and retain high quality colleagues and collaborators with similar core values.

COLLABORATION
Promote and support an outstanding team that integrates a diversity of knowledge, experience, ideas, and skills supportive of our mission/visions.

INTEGRITY
Perform our roles in an ethical framework, which enhances our reputation as honest, trustworthy, and responsible.

RESPECT
Create an innovative, engaging, and inclusive work environment, appreciative of individual differences and contributions. Our workplace will be conducive to personal growth and development that is aligned with our overall mission.
2020 BY THE NUMBERS

16,969
Citations generated from CVC-authored papers published between 2016–2020

13
Clinical trials and registries

11
Population health and data science studies

187
Publications produced by CVC faculty and staff

89
Active sites participating in CVC-managed trials

800+
ECGs analyzed

2.5 M
Canadians represented in the CVC’s data repository
This section highlights the innovative and expansive research projects undertaken by the CVC in 2020, and some of the key contributions from our faculty, staff, and trainees. These highlights are categorized into six research areas: acute coronary syndromes, atrial fibrillation, critical care and cardiac surgery, heart failure, syncope, and women’s health. This work exemplifies our organization’s dedication to collaboration, innovation, and bridging the gap between clinical research and real-world evidence.
Looking Beyond the Primary Hypothesis of Clinical Trials

13 years after the CVC-led team published the primary findings of APEX-AMI (Assessment of PeriLixazub in Acute Myocardial Infarction), an evaluation was undertaken of the long-term impact of large clinical trials such as this. The CVC team investigated the potential incremental value of the APEX-AMI trial based on novel insights into diagnosis, treatment, and care of patients, as well as possible mechanistic insights into their pathophysiology. This systematic examination found 49 additional published manuscripts extending the learnings beyond the primary results. Despite the APEX-AMI trial being deemed “negative”, it is key to recognize that even studies that do not fulfill their primary objective can nonetheless contribute to enlightened care, knowledge, and future research.


Improving the Design of Future PCI Trials for Stable Coronary Artery Disease

The use of revascularization for patients with stable coronary artery disease (CAD) remains highly debated. The authors of this state-of-the-art review – which was developed following an expert session during the 14th annual Global Cardiovascular Clinical Trials (CVCT) Forum – examined the questions arising from this debate, and provided a perspective on the conduct and design of revascularization clinical trials. They emphasized the importance of engaging multiple stakeholders, including patients, researchers, regulators, and funders, in this process to ensure design elements of future trials prove valid and clinically relevant.


Complete Revascularization Associated with Improved Clinical Outcomes

This large contemporary population health analysis in acute coronary syndrome (ACS) patients with multivessel disease on their baseline angiogram, found that percutaneous coronary intervention (PCI) with complete revascularization was associated with a 22% reduction in death and myocardial infarction (MI). Furthermore, the degree of complete revascularization measured by angiographic jeopardy score post-PCI was linearly related to the reduced death/MI - potentially identifying a clinician’s target of less than 10% residual jeopardy.


Selected Stable Patients with High-Risk Coronary Anatomy Benefit from an Invasive Strategy

The ISCHEMIA (International Study of Comparative Health Effectiveness with Medical and Invasive Approaches) trial failed to demonstrate a clinical benefit from an early invasive strategy in patients with stable ischemic heart disease (SIHD). These results prompted the authors to investigate whether SIHD patients with high-risk coronary anatomy would benefit from invasive approaches, such as stents or bypass surgery. Their examination of patient data from more than 9,000 Albertans showed that these patients would benefit from an invasive approach as compared to more conservative therapies.


Our results are helpful in those patients with high-risk coronary anatomy, as we have shown revascularization improves survival and reduces the risk of myocardial infarction.”

– Dr. Kevin Bainey

AEGIS-II

AEGIS-II (Apo-A-I Event Reducing in Ischemic Syndromes II) is a study investigating the efficacy and safety of Apolipoprotein A-I infusions on reducing the risk of major adverse cardiac events in patients with acute coronary syndrome and multivessel coronary artery disease.


STREAM-2

The original STREAM (Strategic Reperfusion Early After Myocardial Infarction) landmark study illustrated that in patients presenting early with ST-elevation myocardial infarction (STEMI), a pharmacoinvasive strategy was at least as effective as primary percutaneous coronary intervention (pPCI). Based on these results, the STREAM-2 trial was designed as a new investigative study comparing the efficacy and safety using half-dose tenecteplase as part of a pharmacoinvasive strategy with pPCI in patients over 60 years with STEMI.


“Now that a pharmacoinvasive strategy is part of the STEMI guidelines – based on the first STREAM trial – STREAM-2 is crucially relevant in exploring whether we can provide an even safer treatment, while at the same time still maintaining efficacy.”

– Dr. Paul W. Armstrong

Apo-A-I is the primary functional component of high-density lipoprotein (HDL)—the so-called “good cholesterol”—and supports the rapid removal of cholesterol from coronary artery plaque. We are hoping that these four 2-hour infusions of Apo-A-I derived from human plasma, and given weekly after a heart attack, will result in significant cholesterol “efflux” and translate into a safe and effective way to reduce the risk of recurrent cardiovascular events.

– Dr. Shaun Goodman

The study represents several years of development and collaboration with Canadian (Drs. Jacob Udell and Shelley Zieroth) and American (Drs. Adrian Hernandez and Schuyler Jones from the Duke Clinical Research Institute) academic leaders and partners, and the trial sponsors. The study design and execution will contain several pragmatic elements, including streamlined approaches to patient follow-up, safety monitoring, and event review; these are particularly important when running a cardiovascular outcome trial during the pandemic.”

– Dr. Shaun Goodman

SONOSTEMI-LYSIS

SONOSTEMI-LYSIS (Sonothrombolysis in Patients with an ST-segment Elevation Myocardial Infarction (STEMI) with Fibrinolysis) is a randomized study investigating the effects of sonothrombolysis in adult patients presenting with STEMI within 6 hours of the onset of symptoms and receiving reperfusion therapy with fibrinolysis as part of a pharmacoinvasive strategy. This is the first study in the world evaluating sonothrombolysis in STEMI patients treated with a pharmacoinvasive approach.

EMPACT-MI

EMPACT-MI (Empagliflozin for the Prevention of Chronic Heart Failure and Mortality After an Acute Myocardial Infarction) is a new pragmatic study launched in late 2020. This trial is investigating whether empagliflozin, a first in class SGLT2 inhibitor, can be used to prevent heart failure and death after a heart attack.

Visit the publications archive on the CVC website to view additional publications on acute coronary syndromes.

PUBLICATIONS
Atrial fibrillation (AF) is the most common cardiac rhythm disorder encountered in clinical practice. The consequences associated with AF are significant, with a five-fold increase risk for ischemic stroke, a three-fold increase risk in developing heart failure, and a near doubling in mortality. The prevalence of AF is rapidly rising and is projected to double over the next 30 years due to an aging population, increasingly adverse lifestyles, and cardiovascular risk factors. The CVC is partnering with colleagues from British Columbia and other provinces, national agencies, such as the Canadian Cardiovascular Society, and industry to investigate the burden of AF in Canada.

Follow-up Care Improves Outcomes in Newly Diagnosed AF Patients

Patients with atrial fibrillation (AF) often first present to the emergency department (ED). As such, this study investigated follow-up care and outcomes of newly diagnosed AF patients treated and released from EDs in Alberta. The authors found that the patients who benefited from cardiology care follow-up were at lower risk of deaths, strokes, and major bleeds. These findings suggest that patient outcomes may be improved by specialist care, and call for further investigation of care delivery models.


Hospitalization Rate for Incident NVAF/ AFL Declining in Canada

Hospitalization for atrial fibrillation (AF) is common and results in substantial health care costs. Current national data trends for the incidence, stroke risk profiles, and mortality for incident non-valvular AF (NVAF) and atrial flutter (AFL) are sparse. These data are important to ensure cost containment and guide resource allocation. Accordingly, the authors examined temporal trends in population rates of incident NVAF/AFL hospitalizations, stroke risk, and in-hospital mortality rates across Canada, except Quebec, between 2006 and 2015. They found hospitalization rates declined nationally and provincially over this time. The majority of patients hospitalized were at high-risk of stroke and this risk has not changed. In-hospital mortality remains high despite a 2% annual rate decline.


The 2020 CCS/CHRS AF Guidelines

The Canadian Cardiovascular Society (CCS)/Canadian Heart Rhythm Society (CHRS) atrial fibrillation (AF) guidelines program was designed to assist clinicians in treating these complex patients, while also guiding policy makers and health care systems on associated issues. The authors of these guidelines are chosen for their expertise and contributions to the field, and in this instance, two CVC faculty members (Drs. Sean McMurtry and Roopinder Sandhu) were chosen to participate and provide insight in this important area.

Since their inception in the 1960s as acute care wards for patients with myocardial infarction due to the development of common arrhythmias, coronary care units have evolved into cardiac intensive care units (CICU) for critically ill patients with cardiovascular disease complicated by multisystem organ failure. Early in CVC history, the focus was on new treatment options for patients with ST-elevation myocardial infarction, however, this has evolved to look at a broader population (such as those with heart failure and arrhythmias), how CICUs are utilized, and strategy-based studies of how to manage this population.

**Timely Mechanical Ventilation Decreases Mortality in Patients with Cardiogenic Shock**

The authors of this study examined optimal timing of mechanical ventilation in acute myocardial infarction (MI) patients with refractory cardiogenic shock. Analysing a patient population from the TRIUMPH (Tilarginine Acetate Injection in a Randomized International Study in Unstable MI Patients with Cardiogenic Shock) trial, the authors found that the risk of mortality increased with each hour of delayed mechanical ventilation. The timely administration of mechanical ventilation in this high-risk patient population merits future investigation through larger randomized studies.


**Benefits of Levosimendan in Patients Undergoing Cardiac Surgery**

Previous studies of levosimendan suggested efficacy in patients undergoing isolated coronary artery bypass grafting (CABG) surgery, however, the LEVO-CTS (Levosimendan in Patients with Left Ventricular Systolic Dysfunction Undergoing Cardiac Surgery Requiring Cardiopulmonary Bypass) trial found no differences in outcomes between levosimendan and placebo in patients undergoing cardiac surgery. In this subgroup analysis, the authors observed that although levosimendan was associated with lower mortality and low cardiac output syndrome in patients undergoing isolated CABG, no such benefits were identified in those undergoing isolated valve or combined CABG/valve procedures.


**Patients in CICUs at Higher Risk of Acute Renal Failure**

This study examined data from the Critical Care Cardiology Trials Network Registry, focused on acute and medically complex patients in the cardiac intensive care unit (CICU) requiring acute renal replacement therapies (RRT). The authors’ findings underscore the high-risk of acute renal failure in patients with a primary cardiovascular diagnosis. They also highlight the need for CICU-specific risk models to identify those patients most likely to benefit from acute RRT and the groups for which this therapy is potentially futile.


**PRESSURE CABG**

PRESSURE CABG (Protocolized vs Personalized Blood Pressure Peri-Operative Parameters in Coronary Artery Bypass Grafting Surgery) is a study seeking to identify the clinical outcomes of personalized peri-operative mean arterial blood pressure (defined as an average of multiple pre-operative in-and out-patient blood pressure measurements) versus protocolized mean arterial blood pressure (defined as a mean arterial blood pressure of 60-70mmHg).

This trial will leverage existing registry and electronic medical records infrastructures to capture the majority of clinical outcomes, including the new Alberta electronic medical record (Connect Care) and the Alberta Provincial Project for Outcomes Assessment in Coronary Heart Disease (APPROACH) registry.

In this study, we observed that the provision of RRT was associated with a 42% risk of in-hospital mortality with a more than five-fold higher risk in patients with cardiogenic shock and/or cardiac arrest. I think these data underscore the need to better identify the subset of patients with underlying cardiac disease who will derive benefit from this technology as well as markers of clinical futility.

– Dr. Sean van Diepen
HEART FAILURE

Heart failure continues to exert a toll on patients and impact quality and length of life. Additionally, frequent emergency department visits and hospitalizations affect patients and health systems alike, despite best therapy. The CVC continues its long history in exploring the epidemiology of heart failure, and acute and chronic treatments that will alter the trajectory for these patients.

VICTORIA

The year 2020 will go down as an iconic one for the advancement of knowledge concerning vericiguat’s efficacy in patients with high-risk heart failure. After five years of work, the results of the VICTORIA (Vericiguat Global Study in Subjects with Heart Failure with Reduced Ejection Fraction) trial were a highlight of the late-breaking clinical trials presentations at the American College of Cardiology Scientific Session and simultaneously published in the Journal of the American College of Cardiology—along with a contextual perspective piece in Circulation. The results showed a clinically significant reduction in the composite endpoints of cardiovascular death and heart failure hospitalization amongst over 5,000 patients enrolled in more than 40 countries around the world. These findings were well received by clinicians and the scientific community, and fulfilled an unmet need for thousands of patients afflicted with heart failure. Importantly, presupposed additional work has yielded, and will continue to provide, important future insights into heart failure and the role of vericiguat. One such example has been the discovery of the crucial role of baseline potassium levels in predicting clinical outcomes and the response to this novel therapy.

The CVC team can be justifiably proud that at every phase of the design, conduct, completion, analysis, reporting, and dissemination of the VICTORIA trial results, our vital contributions to this global collaborative effort are evident and will be remembered.

VITALITY-HFpEF: Vericiguat did Not Improve Quality of Life in HFpEF Patients

Given the success of vericiguat in treating heart failure patients with reduced ejection fraction (HFrEF), it was important to evaluate its effects on patients with heart failure with preserved ejection fraction (HFpEF), who are at higher risk for hospitalization, mortality, and reduced quality of life due to functional limitations. The VITALITY-HFpEF (Effect of Vericiguat vs Placebo on Quality of Life in Patients with HFpEF) trial sought to evaluate the safety and efficacy of vericiguat on the physical limitation score of the Kansas City Cardiomyopathy Questionnaire. Despite vericiguat’s efficacy in HFrEF patients, no benefits were found among those with HFpEF and recent decompensation, and did not improve outcomes.


Change of Health-Related Quality of Life in Patients with Heart Failure

Using the Alberta HEART (Heart Failure Astology and Analysis Team) cohort, the authors investigated the change of health-related quality of life (HRQoL) in patients across the risk spectrum of heart failure. Patients with heart failure and preserved-ejection fraction (HFpEF) had numerically lower quality of life compared to patients with heart failure with reduced ejection fraction (HFrEF). A decrease in quality of life over time was associated with adverse clinical outcomes and this association was stronger in HFrEF than in HFpEF. The observed variability between different heart failure subtypes and patient trajectories suggests the potential for using HRQoL measures to assess the quality of heart failure care in health systems.


SODIUM-HF

Patients with heart failure are recommended to reduce the amount of salt in their diet, but the total amount of salt they should consume per day remains unclear. SODIUM-HF (Study of Dietary Intervention Under 100 MMOL in Heart Failure) examines the effects of a low-salt diet compared to usual dietary recommendations for people with heart failure. This study brings together health care professionals and patients from across Australia, Canada, Chile, Columbia, Mexico, and New Zealand. As part of SODIUM-HF, the CVC initiated the Food Record Core Lab, which is tasked with receiving, tracking, and analyzing food records, to help further this research.


HEART-FID

The HEART-FID (A Randomized, Double-Blind, Placebo-Controlled Study to Investigate the Efficacy and Safety of Injectafér® (Ferric Carboxymaltose) as Treatment for Heart Failure with Iron Deficiency) seeks to determine the efficacy and safety of iron therapy using intravenous ferric carboxymaltose, relative to placebo, in the treatment of patients with heart failure with reduced ejection fraction and iron deficiency.

"Functional iron deficiency has been established as an important risk factor for poor outcomes for patients with heart failure. Early trials testing injecting iron with intravenous iron have shown some promising results to reduce hospitalizations and improve quality of life, but larger trials testing this strategy for a reduction in mortality and hospitalizations is needed, and that is what the HEART-FID trial will do.”

– Dr. Justin Ezekwowitz

Visit the publications archive on the CVC website to view additional publications on heart failure.

PUBLICATIONS
SYNCOPE

Syncope, defined as transient loss of consciousness associated with an inability to maintain postural tone followed by rapid and spontaneous recovery, is a common symptom and reason for health care encounters. Since syncope may be the final common presentation for various conditions, determining the underlying diagnosis and estimating prognosis can be challenging. This often results in an unstructured approach to evaluation, which is ineffective and costly. The CVC is using Alberta’s unique integrated population-level data, which can track a patient from the emergency department to the hospital and beyond, to further examine the impact of syncope on both short-term and long-term outcomes.

Hospitalization Offers No Benefit for Syncope Patients

Patients who experience syncope are often admitted to the hospital, but whether this improves outcomes remains unknown. The authors of this study analyzed administrative data for patients with syncope in all Alberta emergency departments (EDs) between 2004 and 2012, and concluded that there was no discernible benefit of hospitalization for patients who presented to the ED with syncope.


Cost-Balancing Strategies Needed for Syncope Patients in Canada

Patients with syncope often present to the emergency department (ED), but little is known about their means of arrival (ambulance versus self-presentation), outcomes relating to mode of arrival, discharge status, and costs. This study utilized population health data from Alberta and Ontario to examine rates of discharge, ED visits, readmissions, and estimate costs linked with ambulance use. The authors found that the majority of patients presenting with syncope arrived at the ED by ambulance, and regardless of mode of arrival, the majority were directly discharged home. While the short-term prognosis for all discharged patients was favorable, those who arrived by ambulance incurred high transportation costs. The authors concluded that cost-saving strategies are needed to reduce unnecessary ambulance use.


Sex Differences in Syncope Patients Presenting to ED

The emergency department (ED) is often the first point of contact within the health care system for patients experiencing syncope. The authors of this study sought to understand whether sex-specific differences exist in the management and outcomes of syncope patients who present to the ED. Based on data collected on patients ≥18 years of age presenting to Alberta EDs with syncope, women were more likely to visit the ED than men, but were less likely to be admitted to the hospital. The results also demonstrated that regardless of discharge status, mortality rates were notably lower for women.


Cost Burden of Syncope Hospitalization in Canada

Syncope can often result in hospital admission. Compared to other countries, admission rates in Canada are significantly lower. At present, the current and future cost burden of syncope hospitalizations in Canada are unknown. The authors of this study estimated costs of hospitalizations for patients admitted with a primary diagnosis of syncope in Canada between 2004 and 2015 and extrapolated the future cost burden to 2030. They concluded that over a 10-year period the cost of syncope to the health care system is over 800 million dollars. The annual costs of hospitalizations have been increasing over time and are projected to increase almost 30% by 2030. Based on these findings, the authors stress the need for future research to identify strategies to deliver more efficient syncope care.


CSS Clinical Practice Update on the Assessment and Management of Syncope

In 2020 the Canadian Cardiovascular Society (CSS) published the first clinical practice update on the assessment and management of syncope. Dr. Roopinder Sandhu was selected to chair this initiative based on her broad clinical and research expertise.


Visit the publications archive on the CVC website to view additional publications on syncope.

Better risk stratification tools are needed to identify which syncope patients should be admitted from the ED. This could potentially help in the development of standardized protocols and reduce variability in practice patterns. “

– Dr. Padma Kaul

This clinical practice update highlights similarities and differences among recently published guidelines on the diagnosis and management of syncope from the American College of Cardiology/American Heart Association/Heart Rhythm Society and the European Society of Cardiology, draws on new data, and takes the best available evidence and clinical experience to provide clinical practice tips for what might be most useful for practicing physicians. Where appropriate we focus on a Canadian perspective to illuminate larger international issues.”

– Dr. Roopinder Sandhu

2020 ANNUAL REPORT
Women’s Health

Heart disease is a leading cause of death in both men and women in Canada, however, it is more likely to be missed in women than men. This may be due, in part, to the fact that women are known to present with different types of symptoms than men. Women also tend to delay seeking emergency medical services, which leads to longer times between symptom onset and receiving treatment. Additionally, the CVC is exploring early markers, such as adverse events during pregnancy, to identify women at high-risk of developing heart disease.

Women at Higher Risk of Dying Following First Heart Attack

It has been found that women face a 20% higher risk than men of dying or experiencing heart failure during the five years following a myocardial infarction (MI). This study hypothesized that differences in how MI is managed in male and female patients may have changed over time, and thus altered the prognoses after MI, especially the risk for the development of heart failure. The authors examined sex differences in outcomes of patients in Alberta presenting with their first MI. They concluded that women were on average 10 years older, had more chronic conditions, and were more likely to die in hospital than men.


Dr. Padma Kaul Appointed CIHR Sex and Gender Science Chair in Diabetes

Dr. Padma Kaul was appointed the Canadian Institutes of Health Research (CIHR) Sex and Gender Science Chair in Diabetes. As part of this role she is leading the REDISCOVER (Real-world Evidence on the Association between Diabetes and Sex on Cardiovascular Event Rates) study. The REDISCOVER study aims to provide new insights into the relationship of sex and diabetes on cardiovascular disease outcomes.

“When a woman develops diabetes, her so-called ‘natural advantage’ disappears and she is just as likely to develop heart disease as a man.”

– Dr. Padma Kaul

When a woman develops diabetes, her so-called ‘natural advantage’ disappears and she is just as likely to develop heart disease as a man.

Fasting Plasma Glucose in Pregnancy Linked to Adverse Outcomes for Mothers and Babies

Women with gestational diabetes mellitus are at an increased risk of developing hypertensive disorders of pregnancy and having large for gestational age (LGA) babies. Examining over 250,000 pregnancies in Alberta, the study authors concluded that women with elevated fasting glucose were almost three times more likely to have a LGA baby than women who had normal fasting glucose levels but elevated postprandial sugar levels. LGA babies were found to be at risk for complications during birth and obesity later in life. Additionally, mothers with high blood pressure during pregnancy were at risk of increased stress on the heart and kidneys.


Predicting Pregnancy Complications and Long-Term Risk of Cardiovascular Disease

In 2020 Dr. Padma Kaul and her fellow co-applicants were awarded a Canadian Institutes of Health Research (CIHR) grant for their project “Pregnancy Complications and Long-Term Risk of Cardiovascular Disease.” International guidelines are focusing more on the pregnancy period to identify women at higher risk of developing cardiovascular disease (CVD) in the long-term. Evidence suggests that pregnancy factors, such as gestational diabetes mellitus, hypertensive disorders of pregnancy, and neonatal outcomes, may identify women who are at higher risk for future CVD. This study aims to develop and validate clinical risk prediction tools quantifying postpartum risks of CVD in women, utilizing pregnancy and birth cohorts from Alberta and Denmark.

Visit the publications archive on the CVC website to view additional publications on women’s health.

Visit the publications archive on the CVC website to view additional publications on women’s health.
COVID-19 Provides Opportunities to Optimize Health Care

In this review, the authors considered the impact of the COVID-19 pandemic on cardiovascular risk factors and outcomes for patients with and without SARS-CoV-2 infection in the coming years. While there has been a rapid transition to virtual health care because of the pandemic, the authors raise concerns about the effects this is likely to have on risk factor management and continuity of care even for those not infected with SARS-CoV-2.


Impact of COVID-19 on Cardiac Critical Care Delivery

Complications arising from COVID-19 have been shown to affect respiratory, cardiovascular, and immune systems. Critical care cardiologists may be remarkably well positioned to identify patient and workforce needs and provide novel solutions. Despite the challenges presented by the pandemic, it has also provided an unparalleled opportunity to develop scalable models of critical care delivery and enhance collaborative research.


MOIST

The Alberta-based, Canadian Institutes of Health Research-funded MOIST (Multi-Organ Imaging with Serial Testing in COVID-19 Infected Patients) study aims to better understand the impact of COVID-19 on the body’s most vital organs. Using newly developed techniques in magnetic resonance imaging (MRI), the study investigators will scan organs – such as the lungs, heart, brain, and liver – in order to further study the inflammation caused by SARS-CoV-2 and the long-term implications.


Some Children with COVID-19 Show No Symptoms

The authors of this study found that more than one-third of children (< 18 y) diagnosed with COVID-19 are asymptomatic, which suggests that the actual number of children infected with the virus may be higher than statistics imply. Of the symptomatic children who tested positive, the most useful symptoms to distinguish COVID-19 from other causes of flu-like symptoms were altered smell or taste, nausea, headache, and fever (other flu-like symptoms like cough, runny nose, and sore throat were just as common in those without COVID-19). These findings encouraged changes to current screening questionnaires to determine fitness to attend school or work.


STEMI Care During COVID-19

Timely delivery of reperfusion therapy for ST-segment-elevation myocardial infarction (STEMI) patients has been significantly impacted by the COVID-19 pandemic. In this perspective, the authors underscore that the benefit of percutaneous coronary intervention (PCI) is dependent upon promptly attaining first medical contact-to-device times. In the all-too-common instances that reperfusion is delayed, PCI provides no survival advantage when compared to fibrinolytic therapy. To mitigate delays resulting from the pandemic, the authors emphasize that adopting a strategy of early treatment with fibrinolytic therapy (as part of a pharmacoinvasive strategy) is a safe and effective alternative to PCI. They also recommend a re-evaluation of STEMI systems of care to better balance patient needs with limiting health care providers’ exposure to COVID-19.


As the global COVID-19 pandemic has taken its toll on people, workplaces, and overall health and happiness, there are important questions that have seen science at its best. Relatively simple things, such as the number of patients tested for, or with, COVID-19 has shed a spotlight on high-quality, real-time data that will have a lasting impact. Furthermore, rapid development and deployment of diagnostic tests has shown how communities, when focused, can adapt and excel in scientific discoveries. Finally, as the specific cardiovascular relationship to SARS-CoV-2 is explored, it is apparent that testing old and new therapies has brought renewed focus to the continued value of randomized controlled trials.

The following are a selection of COVID-19 research projects that members of the CVC were involved with during 2020.
B2K 20

The 26th annual B2K New Concepts Symposium (B2K20) was held virtually in conjunction with the Canadian Cardiovascular Congress (CCC). Enthusiasm for B2K20 was not dampened by the move to a virtual platform, and it continued to be a highly attended session with over 300 health care professionals joining the event.

Crafted by the B2K20 co-chairs and planning committee, this year’s program assembled a cast of stellar international speakers who expertly delved into cutting-edge topics and new concepts. This year’s topics included heart failure, optimal management of ST-elevation myocardial infarction, and colchicine in coronary artery disease. We gratefully acknowledge our sponsors Bayer and Merck for supporting this year’s symposium.

The CVC also hosted two additional virtual B2K meetings – “ACC.20 Breaking News: The Canadian Perspective” and “ESC 2020 Breaking News: The Canadian Perspective” – following the American College of Cardiology (ACC) Annual Scientific Sessions and European Society of Cardiology (ESC) Congress. Again, we thank our sponsors for supporting these events (AstraZeneca, Bayer, Novartis; AstraZeneca, Bayer, and the Boehringer Ingelheim/Eli Lilly Alliance, respectively).

The CVC continues to explore innovative ways to translate evidence and disseminate knowledge in cardiovascular medicine, particularly during the COVID-19 pandemic.

Canadian Cardiovascular Research Collaboratory (C³)

As described in a recently published manuscript in the Canadian Journal of Cardiology, the C³ aims to identify and study important unanswered questions and address unmet cardiovascular health care needs that would be challenging for a single centre to definitively evaluate, and therefore requires a broader collaboration amongst likeminded individuals. This network further aims to stimulate the rejuvenation and growth of cardiovascular research in Canada by inspiring, nurturing, engaging, connecting, and mentoring the next generation of talented and committed cardiovascular disease researchers. The planning and senior advisory committees, chaired by Drs. Shaun Goodman and Paul W. Armstrong respectively, have facilitated bimonthly teleconferences for five working groups (prevention, heart failure, coronary artery disease, surgery/intervention, and population health) to develop key projects, some of which have received peer-reviewed funding from the Heart & Stroke Foundation and the Canadian Institutes for Health Research (CIHR).

During the COVID-19 pandemic, the C³ embarked upon a series of virtual meetings to explore collaborations in cardiovascular COVID-19 related research. This facilitated several successful peer-reviewed grants (e.g., CIHR, Ontario Together) for randomized clinical trials and observational studies, as well as enhanced awareness of other Canadian-led COVID-19-related projects.
On March 1st, 2020, we welcomed 19 sites from 8 different provinces to participate in the 7th Annual CVC Clinical Trials Colloquium in Banff, Alberta. This event aims to bring together investigative sites, sponsors, academic partners, operational experts, and invited speakers to collectively discuss optimizing clinical research in Canada. Topics from this year included building and maintaining strong research teams, patient engagement and advocacy, best practices for regulatory inspections and audits, and technology and pragmatic design in research. The breakout sessions throughout the day were engaging, informative, explored varying perspectives, and provided key takeaways which we look forward to implementing in the years ahead.

A special acknowledgement to our colleagues Lisa Berdan and Craig Reist from the Duke Clinical Research Institute/North Carolina and Jillianne Code, co-founder of the HeartLife Foundation and patient advocate, who shared their expertise and actively participated in the sessions. A sincere thank you to our sponsors Amgen, AstraZeneca, BMS-Pfizer Alliance, Boehringer-Ingelheim, CSL Behring, and Novartis for their support towards making this event possible.

As part of our 2019-24 strategic vision, the CVC focused on enriching our organizational framework by engaging Canadian site principal investigators (PIs) and study coordinators (SCs) as true partners in the CVC research programs. Together with co-chairs, Drs. Shelley Zieroth and Warren Cantor, we established the CVC Site Engagement Working Group in 2020. The working group collaborated with PI and SC representatives to establish the following priorities:

1. Provide broad strategic advice on future preferred directions for clinical cardiovascular research.
2. Provide a perspective on regional cardiovascular priorities towards which future research might be directed.
3. Advise the CVC regarding logistics, operations, and funding for studies prior to start-up and throughout the course of the trial.
4. Inform the CVC on optimal ways to support and communicate with sites.
5. Identify and assist the CVC in mentoring new PIs and SCs at established and new sites.

SC Representatives: Alice Mahe, Tracy Cleveland, Noreen Lounsbury.
The Next Generation of Health Researchers

As a learning organization, one of the CVC’s central tenets is to engage the next generation of health professionals in a research culture that embraces curiosity, welcomes new ideas, and seeks to address key unanswered questions that are likely to alter the minds and actions of all those involved in health care delivery.

The CVC recognizes that a research experience can be life changing, whether during a summer studentship, an elective experience in clinical medicine, or through dedicated graduate or postdoctoral training. Irrespective of an individual trainee’s career plans, exposure to research galvanizes the development of a more critical mind that can then be applied to the unending search for better health solutions. In the following section, four of our trainees reflect upon their research highlights and experience collaborating with the CVC in 2020.

Elinor (Mengxiao) Wang
Master’s Student, Biostatistics

You joined the CVC remotely from the University of Waterloo for a co-op term during your master’s studies in biostatistics. Can you tell us a bit about your research interests and goals?

I am interested in the development and application of statistical methods for public health, with a specific focus on survival analysis and longitudinal analysis. I want to contribute to help people’s well-being using what I have learned and get more familiar with the use of SAS software.

Your co-op with the CVC was impacted by the COVID-19 pandemic. What did you learn from having to pivot to a remote training experience?

I think it has shown me the importance of conveying information via email. I learned to be more specific in email communication. I also learned to take the initiative and ask rather than spending too much time being stuck.

What have you learned from working with your mentor(s) at the CVC, and what are your research highlights?

I am very grateful to everyone at the CVC. Karen Mellor helped me with my virtual desktop setup questions, Dr. Cindy Westerhout met with me regularly to ensure I was on track, and Dr. Ana Savu helped me with my first project on gestational diabetes mellitus C-section and induction and was very accessible. Dr. Doug Dover was extremely patient and walked me through our current project on the peripheral artery disease risk score. I familiarized myself with medical coding and medical concepts and worked with the administrative database. I attended meetings with Drs. Pishoy Gouda and Robert Welsh and learned their perspectives as clinicians and what they wanted to accomplish with the project. This was a very new but exciting experience for me. I am highly grateful for the opportunity to learn from my mentors at the CVC.
The three of you joined the CVC from the University Medical Center Groningen, Netherlands to collaborate on your bachelor project. Can you describe this project and your research goals?

We had a great time at the CVC and would like to share our memorable experience. It all started when Dr. Adriaan A. Voors from the University Medical Center Groningen in the Netherlands connected us with Dr. Justin Ezekowitz. In February 2020, we travelled to Edmonton. As Dutch medical students, we were not used to the extreme cold temperatures. Nevertheless, the CVC gave us a very warm welcome and everyone was very eager to guide us in our journey. We joined the CVC to write our bachelor thesis and get a good research experience. The aim was to study sex differences in clinical outcomes of patients hospitalized for acute heart failure with renal dysfunction. Furthermore, we evaluated if there were sex differences in the prevalence of renal function and ejection fraction. For this post-hoc analysis, data from the ASCEND–HF (Acute Study of Clinical Effectiveness of Nesiritide in Decompensated Heart Failure) trial was used.

What have you learned from working with your mentor(s) at the CVC?

Our research was mentored by Drs. Justin Ezekowitz, Cindy Westerhout, and Nariman Sepehrvand. They provided us with various learning opportunities and skills, such as reviewing literature and making a statistical analysis plan. Furthermore, we were taught how to interpret results and write a conclusion. We were given a toolset that helped us throughout every step of our research journey and they stimulated us to bring forward all of our ideas and questions. They used a collaborative working style and engaged us in every step of the process. It was an honour to work in a team of such experienced and knowledgeable researchers.

Even now that we are back in the Netherlands, we have received great support in writing our first two manuscripts. We are very grateful that in this way we can continue to grow in the field of medical research. Next to teaching us a lot, Justin, Cindy, and Nariman also took great care for our well-being and safety. Their commitment to making our stay successful is something that we appreciate very much and are thankful for.

What are your research highlights from your time at the CVC?

Since we were only third-year medical students, we did not have much experience in the research field. At the end of our stay, we finished the cardioenal project and wrote a review about the prognostic value of chloride in heart failure. At the moment, we are busy with publishing both manuscripts. Due to hard work, good cooperation, and perseverance we were able to exceed our initial goals. Aside from doing research, we got daily ECG lectures from Eric Ly. We have benefited a lot from this during our current internships at the clinic. Another absolute highlight was being able to visit the ACC Rockies conference in Banff. This conference taught us a great deal of new topics in the field of cardiology. Each of the speakers gave very interesting and informative talks, which showed their great talents. We hope that one day we are able to also give a talk like them.

Your time at the CVC was impacted by the COVID-19 pandemic. What did you learn from this experience and how did it affect your research?

We were at the ski slope in Lake Louise when we received the news from our University that their advice was to return to the Netherlands. Since the circumstances were a lot worse in our home country, we decided to stay in Edmonton. We could not have made this decision without the support and good care of our mentors. When the office of the CVC closed, we worked from home. This was quite an adjustment – we moved to online meetings and suddenly it was not possible to have a chat at the coffee machine with other CVC employees anymore. In the end, the two–month lockdown provided us full focus for our projects. Two flights were cancelled so we could stay one extra month in Canada. This gave us the opportunity to do some sightseeing and discover the beautiful landscapes Canada has to offer.

RIANNE ZANDIJK, MARIJE VAN NOREL, AND FLORINE JULIUS
Undergraduate Students, Medicine

Dr. Shaun Goodman was selected as the 2020 Canadian Cardiovascular Society (CCS) Distinguished Teacher/Mentor Award recipient. This award was created to acknowledge an individual’s excellence in teaching over the long term in any of the cardiovascular fields and recognition of a deep commitment to fostering the professional development of CCS members or members-in-training. A panel of Dr. Goodman’s peers selected him from amongst several nominees to recognize his “outstanding contribution to Canadian cardiovascular health and care.”

Dr. Shaun Goodman

"...TO ACHIEVE THIS WONDERFUL RECOGNITION WOULDN’T BE POSSIBLE WITHOUT THE SUPPORT OF MY OWN TEACHERS, MENTORS, COLLEAGUES, AND FRIENDS AND I WISH TO ACKNOWLEDGE IN PARTICULAR DR. PAUL ARMSTRONG, WHO CONTINUES TO GUIDE ME SINCE MY FIRST YEAR OF CARDIOLOGY TRAINING 30 YEARS AGO, AND THE REST OF THE CVC TEAM."

– DR. SHAUN GOODMAN

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The CVC is anchored by a dedicated group of internationally recognized thought leaders in cardiovascular medicine and clinical investigation, and is supported by accomplished administrative and clinical operations teams, as well as experienced biostatisticians, data and machine analysts, and ECG Core Laboratory personnel.

Research is a team sport, and our diverse and multidimensional CVC personnel are committed to continuous innovation that has an impact on informing health policy.
The CVC faculty are internationally recognized as thought leaders in their respective areas of interest, and they collectively represent a diverse field of clinical research. Our faculty are passionately dedicated to advancing the frontiers of cardiovascular science through several domains:

- **Clinical Trials** – architecture, operational management, analysis, and interpretation.
- **Registry Development** – creative insights into the process of care of acute coronary syndromes and congestive heart failure.
- **Large Population Databases** – informing the impact of research on practice, and pointing towards unmet needs and future directions.

Our faculty plays a pivotal role in linking new knowledge to the community, understanding the implications on health outcomes, embracing the quality feedback loop, and discovering science through clinical trials registries and population outcomes. They are deeply engaged in identifying, nurturing, and mentoring the health professionals and leaders of tomorrow by grounding them in the discipline of cardiovascular research.
PAUL W. ARMSTRONG, MD

- Founding Director, Canadian VIGOUR Centre
- Distinguished University Professor, Division of Cardiology, University of Alberta
- Former Chair of the Department of Medicine, University of Alberta
- Founding Director of TORCH (Tomorrow’s Research Cardiovascular Health Professionals), a Strategic Training Program Initiative
- Founding President of the Canadian Academy of Health Sciences
- Officer of the Order of Canada
- Cited amongst the top 10 most productive authors in the medical literature

Dr. Armstrong’s research interests include:
- Development of novel methods to enhance clinical trial methodology
- Cardiovascular implications of diabetes and aging
- Pathophysiology and novel therapeutic approaches of congestive heart failure
- Diagnosis and management of acute coronary syndromes, with emphasis on timely interventions

JUSTIN EZEKOWITZ, MBBCh, MSc

- Co-Director, Canadian VIGOUR Centre
- Professor, Division of Cardiology, University of Alberta
- Director, Cardiovascular Research, University of Alberta

Dr. Ezekowitz’ research interests include:
- Testing the impact of drugs, existing care, and processes of care for patients with acute and chronic heart failure
- Non-pharmacologic interventions such as dietary sodium or altering the gut microbiome, and existing tools such as biomarkers for discovery or prognosis
- Population health studies on outcomes and interventions
- Clinical trial design and endpoints

SHAUN GOODMAN, MD, MSc

- Co-Director, Canadian VIGOUR Centre
- Adjunct Professor, Department of Medicine, University of Alberta
- Associate Head, Division of Cardiology, Department of Medicine, St. Michael’s Hospital
- Heart & Stroke Foundation of Ontario (Polo) Chair and Professor, Department of Medicine, University of Toronto

Dr. Goodman’s research interests include:
Facilitating collaborative clinical trial, observational, and knowledge translation research in cardiovascular disease in Canada with a focus on:
- Diagnosis, management, and prognosis of acute and chronic coronary syndromes
- Secondary prevention of cardiovascular disease, including those with diabetes mellitus
- Optimal stroke prevention risk stratification and management in atrial fibrillation

PADMA KAUL, PhD

- Co-Director, Canadian VIGOUR Centre
- Professor, Department of Medicine, University of Alberta
- Adjunct Professor, School of Public Health, University of Alberta
- Adjunct Professor, Department of Population Health Sciences, Duke University
- Canadian Institutes of Health Research Chair (CIHR), Sex and Gender Differences, Diabetes
- Heart & Stroke Chair in Cardiovascular Research

Dr. Kaul’s research interests include:
- International differences in practice patterns and outcomes
- Sex differences in treatment and outcomes of cardiovascular disease
- Long term chronic disease implications for pregnancy-related complications
- Issues related to access, delivery, and costs of care at a population level
KEVIN R. BAINEY, MD, MSc
• Director, ECG Core Laboratory, Canadian VIGOUR Centre
• Interventional Cardiologist, Mazankowski Alberta Heart Institute
• Associate Professor, Division of Cardiology, University of Alberta
• Director, Adult Cardiac Catheterization and Interventional Cardiology Laboratory
• Director, Interventional Cardiology Fellowship Program
• Co-Director of the Acute Coronary Syndrome (ACS) Working Group, Alberta Health Services Cardiovascular Health and Stroke Strategic Clinical Network

Dr. Bainey’s research interests include:
• Optimizing reperfusion strategies in ST-elevation myocardial infarction
• Population health outcomes in acute coronary syndromes

FINLAY McALISTER, MD, MSc
• General Internist, University of Alberta Hospital
• Professor, Division of General Internal Medicine, University of Alberta
• Scientific Director, Alberta SPOR (Support for Patient-Oriented Research) Unit
• Alberta Health Services Chair in Cardiovascular Outcomes Research
• Past-Chair, Outcomes Research Task Force, Canadian Hypertension Education Program
• Past-President, Canadian Society of Internal Medicine

Dr. McAlister’s research interests include:
• Outcomes research in hypertension, heart failure, perioperative care, and coronary artery disease
• Clinical epidemiology methodology with a focus on evidence-based medicine and implementation of evidence at the bedside
• Methodology of trials and systematic reviews

M. SEAN MCMURTRY, MD, PhD
• Clinician Scientist, Mazankowski Alberta Heart Institute
• Associate Professor, Division of Cardiology, University of Alberta
• Program Director, Clinical Investigator Program, University of Alberta

Dr. McMurtry’s research interests include:
• Thoracic aortic disease
• Peripheral artery disease
• Coronary artery disease
• Sex differences in cardiovascular disease
• Men’s health

ROOPINDER SANDHU, MD, MPH
• Cardiac Electrophysiologist, Associate Professor, Department of Cardiology, Smidt Heart Institute, Cedars-Sinai Medical Center, Los Angeles
• Director of the Device Clinic, Smidt Heart Institute, Cedars-Sinai Medical Center, Los Angeles
• Associate Professor-in-Residence, Department of Medicine, David Geffen School of Medicine, University of California, Los Angeles
• Associate Adjunct Professor, Department of Medicine, Division of Cardiology, University of Alberta
• Visiting Scientist, Brigham and Women’s Hospital, Boston
• Co-Director, Edmonton Cardiac Arrhythmia Trials (ECAT) group

Dr. Sandhu’s research interests include:
• Arrhythmia health services and outcomes research
• Atrial fibrillation
• Cardiac implantable devices
• Syncope
SEAN VAN DIEPEN, MD, MSc

- Academic Cardiologist-Intensivist, University of Alberta Hospital
- Co-Director, Coronary Intensive Care Unit, University of Alberta Hospital
- Assistant Professor, Department of Critical Care Medicine and Division of Cardiology, Department of Medicine, University of Alberta
- Associate Editor, American Heart Journal and European Heart Journal. Acute Cardiovascular Care

Dr. van Diepen’s research interests include:
- Critical care cardiology
- Cardiovascular surgical care
- Critical care resource utilization

ROBERT WELSH, MD

- Interventional Cardiologist, Mazankowski Alberta Heart Institute
- Professor, Division of Cardiology, University of Alberta
- Edmonton Zone Clinical Department Head, Cardiac Sciences
- Chair, Canadian Cardiovascular Society, Percutaneous Coronary Intervention (PCI) Quality Working Group
- Co-Chair, Transcatheter Aortic Valve Implantation (TAVI) Program, Mazankowski Alberta Heart Institute

Dr. Welsh’s research interests include:
- Acute coronary syndromes and interventional cardiology
- Atherosclerotic cardiovascular disease
- Cardiovascular disease and diabetes
- Exercise physiology and cardiac physiology
- Pre-hospital management of ST-elevation myocardial infarction, and the interaction of pharmacological (antithrombotic and fibrinolytic) and mechanical interventions (primary and rescue angioplasty)

“WHAT IS GREAT IN MAN IS THAT HE IS A BRIDGE AND NOT A GOAL.”
- FRIEDRICH NIETZSCHE
BIOSTATISTICS

Biostatistics at the CVC is a collective of applied biostatisticians with diverse training, experience, and practice. We collaborate with local, national, and international investigative teams by applying statistical reasoning and methods to the wide range of research interests in cardiovascular and women’s health. Our team contributes to the quantitative aspects of research through study design, conduct, analysis, and interpretation of findings and studies. Our biostatisticians are experienced in working with a wide variety of data sources, both primary and secondary. They are closely involved in generating academic works, such as abstracts and presentations for scientific meetings, and manuscripts published in peer-reviewed journals.

Our biostatisticians are contributing to the leading edge of new methodologies and providing guidance on these evolving applications in health research. We collaborate and network with others in the field at the local level through the Biomedical Analytics Studio and Methods (BALSAM) Network, Alberta SPOR SUPPORT Unit (AbSPORU), and Women’s and Children’s Health Research Institute (WCHRI), and at national/international levels through multiple randomized clinical trial statistics working groups (e.g., GUIDE-IT, VICTORIA, TECOS, ISCHEMIA). Our biostatisticians also provide guidance to students, residents, and junior clinical researchers.

POPULATION HEALTH AND ECONOMIC OUTCOMES

The CVC Population Health and Economic Outcomes team is actively involved in examining population-level issues related to access, delivery, treatment, and outcomes of heart disease in Alberta and Canada. Health care administrative databases have become a cornerstone in the process of assessing performance and providing feedback to improve quality of health care delivery at a population-level. The CVC has one of the largest repositories of cardiovascular data at the University of Alberta. This repository currently includes data on approximately 6.5 million hospitalizations for 2.5 million Canadians, and data on hospitalizations, outpatient care, medications, and vital status for over 900,000 Albertans suffering from heart disease over the last decade.

Our team utilizes empirical data from the population-health data repository to develop prediction models to estimate the current and future economic burden of cardiovascular disease on health care systems. In addition to the impact of interventions on mortality and morbidity, there is increasing interest in assessing their impact on patient-reported outcomes such as health-related quality of life (HRQoL). Our team has led the examination of HRQoL outcomes for some of the largest multinational cardiovascular clinical trials.

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

The Artificial Intelligence and Machine Learning (AI/ML) team at the CVC specializes in providing artificial intelligence and machine learning solutions to health care problems, with emphasis on cardiovascular medicine and maternal-child health. We work with large-scale population level datasets to uncover novel and actionable insights that can potentially drive clinical decision making. To this end, our team develops predictive algorithms with the primary goal of deploying clinician-facing applications to identify high-risk patients at the point of care.

With access to unstructured datasets, including millions of 12-lead electrocardiogram (ECG) traces and structured datasets such as administrative health records, the AI/ML team develops algorithms to predict diagnostic and prognostic outcomes including cardiac arrhythmias, rehospitalization, mortality, and other adverse events. Our team applies cutting-edge data science methods, starting from customized data processing pipelines, extensive feature engineering, a variety of conventional and deep learning algorithms, robust model validation schemes, all the way to the development of web applications. We also conduct ML methodology research with strong applications in medicine, such as individualized survival distribution, model fairness, federated learning, and data privacy aspects. Finally, the AI/ML team collaborates with national and international partners in academia and industry, and provides guidance to interns, master’s students, and junior researchers.
With over 20 years of experience in clinical trial operations for Phase II/III/IV and investigator-initiated studies, the CVC Clinical Trials team has the expertise and knowledge to deliver a high-quality and well-executed trial from study start-up to closeout. Having worked with over 460 Canadian site investigators, representing more than 250 institutions nationwide, our team understands their capabilities, and has built and maintained ongoing collaborations with these sites. This understanding enables us to approach the best sites that can deliver the right patients for the study. As an academic research organization, all of the CVC’s clinical trials include the involvement of at least one of our faculty members who are practicing physicians that can relate to the role of the investigator and site.

Led by our associate director of clinical trials, we have a very experienced, diverse, and knowledgeable team comprised of clinical trial project leads, regulatory specialists, a monitoring lead, regionally based monitors, and administrative support. Our team works hard to build and maintain strong relationships with our sites, sponsors, and partners to deliver efficient, cost-effective, and high-quality clinical trials. We also attribute our success managing clinical trials to the hands-on, collaborative team approach we provide to our sites, sponsors, and partners.
The CVC ECG Core Laboratory aims to translate research results into clinically relevant applications. Using the electrocardiogram (ECG) – a venerable but powerful biomarker – we can generate an improved understanding of the pathophysiologic processes involved in acute coronary syndromes, thereby enabling not only better prediction of outcomes, but also assessing treatment effectiveness. These insights serve to further stimulate cardiovascular scientific research.

Our team has a mandate of conducting quality analyses using clinical research data. To date, ECGs from over 75,000 patients enrolled in studies around the world have been analyzed. This provides an excellent database for future clinical trials, additional sub-studies, analyses, and ‘big-data’ research using an artificial intelligence/machine learning approach.
BUSINESS OPERATIONS

The business operations group is fundamental to the organizational and financial underpinnings of the CVC. Reviewing and negotiating contracts is one of our team’s key tasks, along with providing expert service in managing agreements, developing and tracking metrics, overseeing revenue, and administering expenses. We are also committed to the progress of information systems management, strategic planning, process improvement, and the promotion of learning and development initiatives.

Our team is responsible for the development and distribution of all marketing materials aimed at creating strong brand awareness. We also manage the CVC’s website and social media portfolio and provide visual design support to our staff and faculty.

The business operations group plays a key role in leading communications between the CVC and its many institutional partners. We are dedicated to upholding these strong partnerships, which are essential to the day-to-day operations of the CVC.

ACADEMIC RESEARCH ADMINISTRATION

The Academic Research Administrator (ARA) supports the development and management of investigator initiated academic research projects. The ARA facilitates proposal development, from identifying funding sources, coordinating diverse application partners, drafting and refining proposals, and critical review of project design, through to final polish. For research projects underway, the ARA manages ethics approvals, reporting to stakeholders, and knowledge translation by way of manuscript development, graphical abstract design, and data visualizations for various mediums.

Left to right: Lisa Soulard, Leiah Luoma, Karen Mellor; Oksana Grant; Ellen Pyear
The CVC has forged strong partnerships with a number of institutions and centres around the world in the pursuit of novel research directions and the advancement of cardiovascular research. The CVC takes great pride in our relationships with these collaborators, who are internationally recognized leaders in the advancement of cardiovascular research.
ACKNOWLEDGEMENTS

The patients, for their willing participation in our trials and registries. They are the true heroes of clinical research and we honour their volunteer spirit.

The CVC faculty, external advisors, and collaborators for their enriching contributions and for providing ongoing research opportunities. We look forward to providing continued support and to future collaborations in advance of our mission.

The CVC staff and management for their outstanding dedication, professionalism, excellent contributions, and ingenuity, which enhances the quality of our research work.

Our trainees for their commitment, ideas, and enthusiasm. You are the next generation of researchers and health care providers.

The excellent work of our communications group for their time and the dedication required to produce this report.

The sponsors and granting agencies; without their generous financial support our research and educational activities would not be possible.

The team at AM/FM for the concept and design.

Photographer, Richard Siemens, for the group photos of our staff and faculty featured within this report.