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I’m thrilled to present, on behalf of my colleagues throughout our department, the 2021 annual report for the Department of Critical Care Medicine.

Herein we report on important work and accomplishments in addition to challenges we faced during another extraordinary pandemic year. As a clinical and academic department, we integrate clinical programs, education and research to deliver exceptional patient and family centred-care to critically ill patients in the Calgary Zone and associated referral area. Our greatest resources are always our people who are dedicated to the service of others.

Some notable events from 2021 include:

• Continuing to learn, manage and adapt to the changing COVID-19 pandemic, including expanding critical care capacity in the Calgary Zone to over 200% of baseline
• Adaptation of our family resources and guidelines over the course of the pandemic to better support safe but inclusive patient and family centred care
• Achieving significant research success in the setting of an unprecedented pandemic, leading and contributing to important local, national and international scholarship related to both COVID-19 related and other critical care clinical and basic science
• Getting ready for Connect Care - helping shape the content, system design and optimization for use in critical care in Calgary and throughout the province
• Accomplishing substantial quality improvement and knowledge translation work despite pandemic restrictions – contributing to care pathways to optimize the care of patients with pandemic relevant diseases and continuing the journey to deliver value based care
• Successfully actioned a departmental clinical ARP for critical care service at three sites

Despite a continually evolving pandemic, our departmental members continue to lead critical care through their commitment to clinical care, education and research producing exceptional patient-and-family-centered care and continually advancing both the art and science of critical care.

Respectfully,

Dan Zuege MD, MSc, FRCPC
Mission & Vision

VISION
Healthy Albertans. Healthy Communities. Together.

MISSION
To provide a patient-focused, quality health system that is accessible and sustainable for all Albertans.

Cumming School of Medicine University of Calgary

VISION
Creating the future of health.

MISSION
The Cumming School of Medicine (CSM) is driven to create the future of health. We are a proud leader with seven world-class research institutes and more than 2,700 students, as well as faculty and staff, working to advance education and research in precision medicine and precision public health (PM/PPH), improving lives in our community and around the world.

The CSM’s strategic plan focuses on three key areas — people, platforms and partnerships. By continuing to strategically focus on and invest our resources in these three priority areas, we’re creating the ability to focus on PM/PPH; an individualized approach to patient diagnosis, treatment and disease prevention, and the use of emerging technologies to better enhance precision in healthcare. The school is named in honour of UCalgary alumnus Geoffrey Cumming, who provided the largest single philanthropic gift in the university’s history in 2014. The CSM marked its golden anniversary in 2017, celebrating 50 years since our doors opened.
Department Organization, Strategic Planning & Teams

The Departmental functions are principally located at the four acute care sites, with the Peter Lougheed Medical Centre (PLC), Rockyview General Hospital (RGH) and South Health Campus Hospital (SHC) providing general intensive care services while the Foothills Medical Centre (FMC), in addition, provides tertiary services for Trauma and Neurosciences patients. Cardiovascular Surgery Intensive Care Services (CVICU) are provided at the Foothills Medical Centre in a distinct ICU under the supervision of Intensivists from the Department of Critical Care Medicine.

The Calgary Zone reporting relationships and governance of DCCM are provided in the schema outlined below. The DCCM Head is a member of the Zonal Medical Advisory Committee. All DCCM members share responsibility for the vision, goals and advancement of all facets of the Department: exceptional patient-and-family centered critical care. We lead critical care through our commitment to clinical care, education and research. The Department head meets with the members of the Department, Medical Executive Committee and also with the Zonal ICU Executive Council for operational issues on a regular basis. Participation by medical and non-medical ICU practitioners in our weekly Grand Rounds, our annual Research Day, our site based & Zonal Morbidity and Mortality working group review processes with direct links to our Departmental Quality Assurance Committee and finally social programs foster our strong Zonal and inter-disciplinary cooperation.
The following Departmental Councils and Committees meet on a regular basis based on the Terms of Reference for each group. Councils more often have a zone mandate and a broader inter-professional representation than committees.

- Equity, Diversity, & Inclusion Committee
- DCCM Business Meeting
- DCCM Clinical Research Meeting
- ICU Executive Council
- ICU Medical Executive Committee
- Mortality Working Group
- Quality Assurance Committee
- Zonal ICU Outreach Steering Committee
- Zonal Code Blue Committee Meeting
**Focus Area: Clinical Care**

**Goal**
Exceptional patient care that uses practices to optimize patient health outcomes

**Objectives**
Develop a framework for quality management

**Activities**
1. Identify the needs of patients and the critical care team to optimize patient care and co-develop metrics to measure performance
2. Develop a strategy to align clinical guidelines, pathways and performance metrics with current and future clinical information systems

**Focus Area: Leadership**

**Goal**
Develop a Just Culture

**Objectives**
Provide leadership and support for a Just Culture

**Activities**
1. Leadership communication to all members that patient & staff safety is a departmental priority.
2. Discuss quality of care at every ICU executive meeting and at unit meetings

**Objectives**
Align all quality assurance activities with Just Culture principles

**Activities**
1. Educate all members on the principles of Just Culture & their application to the department
2. Task the Quality Assurance Committee to champion Just Culture principles that included patient and team perspectives

**Focus Area: Education**

**Goal #1**
Successful transition of critical care medicine residency program (Competence by Design)

**Objectives**
Successful implementation of CBD transition plan

**Activities**
1. Train all physicians on the fundamental of CBD and support them during the transition
2. Evaluate the effectiveness of the CBD program

**Goal #2**
Professional development to support DCCM member’s pursuit of excellence

**Objectives**
Continuous growth and development of members

**Activities**
1. Solicit feedback to inform professional development opportunities
2. Establish expectations for participation in professional development activities
3. Foster a culture of growth
4. Incorporate educational activities in the accountabilities of all physicians and CSM faculty
Focus Area: Research

Goal #1
Increase interdisciplinary research infrastructure

Objectives
Maximize impact of departmental investment in research

Activities
1. Complete implementations of existing DCCM Clinical Research Strategic Plan
2. Develop and implement a framework for prioritizing investments in research that leverages existing departmental strengths
3. Establish research fund development strategy
4. Support inter-professional research collaborations across departmental sites

Goal #2
Increase member capacity for research

Objectives
Capacitate members to engage in research

Activities
1. Incorporate research activities into the accountabilities of all physicians and CSM faculty
2. Encourage development of interdisciplinary research teams with synergistic interest and expertise
3. Develop an interdisciplinary research training strategy

Members of the Department

Member profiles have been moved to the website. This allows us to provide the most up-to-date list of department members.

There are six categories that members are categorized into:
• Leadership
• Medical Professionals
• Education
• Research
• Student / Trainee
• Support Staff

Workforce Planning

Summary of Recruitment
• Dr. Kevin Solverson, DCCM Intensivist
• Dr. Selena Au, Interim Medical Director, Rockyview Hospital
• Dr. Dan Niven, Medical Director, Peter Lougheed Hospital
• Dr. Jonathan Gaudet, CME Coordinator

University of Calgary Academic Promotions
• Dr. Andreas Kramer - promotion to Clinical Professor effective July 1, 2021
• Dr. Kirsten Fiest – tenure and promotion to Associate Professor effective July 1, 2021
• Dr. Philippe Couillard – promotion to Clinical Associate Professor effective July 1, 2021
• Dr. Ken Parhar - promotion to Clinical Associate Professor effective July 1, 2021

Our Team

Members of the Department

Member profiles have been moved to the website. This allows us to provide the most up-to-date list of department members.
## DCCM Awards & Accomplishments

### DCCM Awards/Recognition/Promotions

<table>
<thead>
<tr>
<th>Name</th>
<th>Recognition/Program Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Michael Dunham</td>
<td>Surgery - Honor Roll</td>
</tr>
<tr>
<td>Julie Kromm</td>
<td>Course 5 Gold Star</td>
</tr>
<tr>
<td>Jason Waechter</td>
<td>Course 3 Gold Star</td>
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<td></td>
<td>ECGs for Dummies Award</td>
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<tr>
<td>Natalia Jaworska</td>
<td>Behind-the-Scene Award - pre-clerkship</td>
</tr>
<tr>
<td>Jason Waechter</td>
<td>Certificate of Appreciation, Dentistry Program</td>
</tr>
<tr>
<td>Kirsten Fiest</td>
<td>Promoted to Associate Professor</td>
</tr>
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<td></td>
<td>OADR Grant Development Webinar series appreciation</td>
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<tr>
<td></td>
<td>Killam Emerging Research Leader Award</td>
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<tr>
<td>Andreas Kramer</td>
<td>Promoted to Clinical Professor</td>
</tr>
<tr>
<td>Ken Parhar</td>
<td>Promoted to Clinical Associate Professor</td>
</tr>
<tr>
<td>Philippe Couillard</td>
<td>Promoted to Clinical Associate Professor</td>
</tr>
<tr>
<td>Bryan Yipp</td>
<td>OADR Grant Development Webinar series appreciation</td>
</tr>
<tr>
<td>Jonathan Gaudet</td>
<td>Royal College Program Director of the Year</td>
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<tr>
<td>Brent Winston</td>
<td>The Michael Ward Award from the Canadian Critical Care Forum for the best basic or translational science study.</td>
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<tr>
<td>Tom Stelfox</td>
<td>2021 CIHR-ICRH/CCCS Distinguished Lecturer Award in Critical Care Sciences. Canadian Institutes of Health Research at the 2021 Critical Care Canada Forum.</td>
</tr>
<tr>
<td>Michael Dunham</td>
<td>Gold Star teaching award, UofC Off Service Preceptor of the Year Award, Emergency Medicine</td>
</tr>
<tr>
<td>Karla Krewulak</td>
<td>Garner King Award for best clinical or quality improvement study</td>
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Communications

DCCM is a joint clinical and academic department, Alberta Health Services – Calgary Zone and Cumming School of Medicine University of Calgary. It is comprised of members spanning multiple disciplines dedicated to improving the care and health of critically ill patients and their families. DCCM leads critical care through our commitment to clinical care, education and research.

As a department our vision is to provide exceptional patient-and-family-centered critical care and our mission is to lead critical care through our commitment to clinical care, education and research. Communications plays a crucial role in our organization’s success, our communications tactics ensure all administrative, operational & educational aspects of our department run smoothly and are up to date.

SMART Goals

- S: Our communication goal is to establish an effective and transparent channel for us to disseminate information to our team and stakeholders
- M: How we measure our success- satisfaction with our team and our stakeholders. We can hold bi-annual survey that measures how transparent, effective and relevant our content and distribution channels are.
- A: Our communications plan is concrete and straightforward, at the core of what our role is to be a tool and resource to our department.
- R: Clear and straightforward communications is part of the core of the department, for DCCM a communications plan is relevant not only for the organizational aspects (Insite web publishing) but also to celebrate our team and our department’s accomplishments.
- T: Our communications strategy and tactics can be continuously assessed through our bi-annual survey and a full audit can be conducted with every department annual review.

Our Audience

DCCM’S primary audience are our staff and physicians. Out of the 4 communications channel 3 of them are directly targeted and can only be accessed as an AHS employee. A key distinction within the DCCM communications scope is that our audience often times are also our content creators. The synergy between our audience and our communications materials presents a unique entity for DCCM. As result, a key goal in our strategy is to maintain an effective and transparent communications channel.

Our secondary audience is our community. Because, DCCM is a joint clinical and academic department our public platform exists on the UCalgary Cumming School of Medicine Website. The UCalgary Critical Care platform is a part of The School of Medicine’s portfolio. In this site, the information available encompasses our team, education and research. In addition, UCalgary site serves a resource to attract medical talent.
Current Communications Channels & Materials:

InSite Website (Internal)
Our InSite website is our main point of contact for our staff and team. We host both clinical and education resources on this site. In this site, each page has an owner and they are responsible submitting updates and keeping their content up to date.

U of C Website (External)
The Critical Care Medicine platform on the University of Calgary website is DCCM’s public platform. On this site we include a description of our department, the scope of our work and our team members. In addition, we have resources related to our academic program for prospecting talent and we do post and advertise professional opportunities on this site.

Newsletters
The DCCM Newsletter in a monthly or bi-monthly reoccurring issue. One of the main features of this communications material is the intro address. This opening section of the newsletter includes a thank you message dedicated towards DCCM staff on behalf of the DCCM executive council and a “Department at a Glance” infographic which captures clinical statistics and bed capacity. The main objective of our department newsletter is to celebrate our talented staff, we include patient success stories, department research and other news worthy DCCM items.

Grand Rounds
Within our InSite website, DCCM has a designated page for the education’s program Grand Rounds. DCCM’s Grand Rounds model, includes a video presentation which we update weekly on our website. DCCM Grand Rounds (presentation and video) are posted for easy access on our website.

Summary
Our communications goal is to maintain an effective and transparent channel for DCCM. Along with keeping our stakeholders in mind we will conduct a bi-annual assessment of our communication channels and materials to ensure our platforms up to date and the workflow is efficient.

Another Year of COVID-19

DCCM began 2021 in the midst of a second wave of COVID-19 in the province. Just as the year before, COVID-19 created significant challenges to our department from a clinical and organizational perspective. However, in the midst of adversity we are proud to share that our DCCM staff rose to the occasion time and time again.
Wave Three (March 22nd - July 1st 2021)

At the peak of Wave 3, we added 52 additional surge beds beyond our usual 66 bed capacity; an increase of 175%. As far as we know, throughout this time, our patients were cared for safely and efficiently with no significant changes in adverse events despite the amount of intra-zonal load leveling required and significant adjustments of our usual team models of care which were required to manage an extraordinary increase in patient load. As our province moved into a new phase of relaunching, DCCM was proud to report that in addition to the thousands of patients we have cared for, another outstanding achievement by our ICU teams is that there were no outbreaks in our ICU’s. Moreover, as far as we know, no physicians or staff contracted COVID from the workplace.

Wave Four (July 18th to September 30th, 2021)

During Wave 4 our team was incredibly adaptable and innovative in ensuring our operations continued to run as smoothly as possible while remaining committed to the highest standard of care for our patients. This has not been an easy feat in the face of COVID-19.

From August 2021 to September 2021 our team achieved the following together:

- A massive and timely bed expansion of +72 surge beds; an unprecedented increase to operating over 200% of our usual baseline capacity
- Adoption of efficient care standards
- Offloaded a total of 45 patients from other overwhelmed zones as part of our provincial Critical Care community (from the South, Central and North Zones collectively)

What our department achieved could not have been done without the flexibility, dedication and diligence of the 347 nurses mobilized and through reassignment & redeployment, the addition 121 pandemic surge physicians, 39 respiratory therapists and of course the admins and behind-the-scenes staff who keep the trains running on time.

Wave Five (Dec 1st 2021 - March 15th, 2022)

We closed 2021 in the midst of another COVID-19 wave, although the Omicron variant impacted our critical care resources and ICU services significantly less in comparison to previous waves, DCCM experienced a substantial effect on our units and staffing. All our hard-working ICU staff have been impacted by the virus through sickness in either friends or family, and of course by having to cover hours and work to make up for colleagues who unable to work because of illness. A silver lining: Critical Care having been in the limelight over the last year of the pandemic had garnered the attention and support of executive leadership in Alberta Health Services and Alberta Health, leading to new investments in our department. This included funding to expand our ICU teams with additional ICU nursing staff, respiratory therapists and additional Nurse Practitioners to expand support at FMC and PLC. These are welcome additions to our already mighty medical and operational teams.

Summary

DCCM would like to acknowledge the immense amount of courage displayed by each and every one of our DCCM team members throughout the past year. The word “courage” as defined by the Oxford Language Dictionary is “strength in the face of pain or grief”; that being said it takes an incredible amount of courage and resilience for us to do indispensable work to care for patients requiring Critical Care through the waves of COVID-19. Among some of the amazing feats we accomplished over the past year; our team learned to adapt and pivot to remain committed to the highest standard of care. Indeed, difficult times make for resilient people and resilient people make for successful teams.

DCCM would like to take a moment to give a big thanks to every single one of our Critical Care staff for always stepping up to the plate to not only adapt but also finding innovative ways to fill the gaps and meet the demand that COVID has thrown at our department. We know this isn’t possible without a great deal of personal sacrifice. Our sincere hope is that as 2022 unfolds there is less COVID related demand and that we can we can allocate ICU resources to put more focus on ourselves and our loved ones; maintaining a mighty and resilient team for years to come.
COVID-19 4th Wave
Redeployment

DCCM Occupancy & COVID-19 Admissions (December 5, 2021 – March 31, 2022)

Insights
What we have accomplished so far

- 72 Surge beds added to zone capacity
- 45 Patients admitted from South, Central & North Zones
- 1,083 Patients admitted into our care in the 4th COVID-19 wave
- 347 Nurses mobilized and through reassignment & redeployment
- 39 Respiratory Therapist mobilized through reassignment & redeployment
- 121 Surge physicians & anesthesiologists added to our team

10% difference
21% difference
60% difference

11% increase in patients within ICUs
21% increase in patients within Ward 6 ICU
60% increase in patients

What we have accomplished we could not have done without our team members’ individual and collective support and sacrifice. On behalf of the Calgary Zone Critical Care community – thank you.
The Department of Critical Care Medicine (DCCM) is a joint clinical and academic department, Alberta Health Services – Calgary Zone and Cumming School of Medicine (CSM), University of Calgary. It is comprised of members spanning multiple disciplines dedicated to improving the care and health of critically ill patients and their families. We lead critical care through our commitment to clinical care, education and research.

A team of 33 intensivists, 1 physiatrist and 1 epidemiologist work alongside a multidisciplinary team of Registered Nurses, Respiratory Therapists, Pharmacists, Physiotherapists, Occupational Therapists, Speech Language Pathologists, Dieticians, Social Workers, Spiritual Care Specialists, Unit Clerks, Health Care Aides, Volunteers, Research Coordinators, QI Staff, Research Analysts and Administrative professionals between 5 adult intensive care units located in 4 hospitals across the Calgary Zone. We have a large complement of residents, medical students and fellows.
**Foothills Medical Centre (FMC)**

The Foothills Medical Centre (FMC) ICU continues to support the largest hospital in Calgary by providing intensive care, code blue and outreach services to over 1100 inpatients and support many key programs for the zone; neurosurgery, stroke, hepatobiliary surgery, head and neck cancer reconstructive surgery, burn care, thoracic surgery, and the bone marrow transplant programs, to name a few.

The unit is physically organized into three separate pods with a funded capacity of 28 patients. Neurotrauma patients and medical-surgical patients are clustered.

In 2021, all efforts were focused on the COVID-19 Pandemic response and increasing ICU capacity. Frequent challenges and changes in our usual operations around Infection Prevention, & Control, cohorting of patients, family presence and human resources were met with adaptability and a focus on patient safety.

Our 28 bed unit treated 52 concurrent patients in Oct 2021 at the height of the pandemic. Recruitment of approximately 170 redeployed nursing staff from throughout the site and zone supported the capacity increase with RN’s with and without previous ICU nursing experience joining the team after just in time education and worked to provide quality patient care in a team nursing model. Physician support from Residents and physicians from the Departments of Anesthesiology and Emergency Medicine was crucial for the pandemic response.

FMC ICU embraces patients and families as partners in care and we encourage their presence at the bedside and involvement in care. One of the greatest challenges of the COVID-19 response were significant changes to family’s access to our unit.

**Site Update: FMC**

**Critical Care Calgary Zone**

**Foothills Medical Centre (FMC Continued...)**

When in-person attendance was not possible, implementation of virtual patient visits, virtual family attendance during daily multidisciplinary rounds, and virtual family conferences with the ICU team supported families in staying connected to their loved ones.

The ICU Outreach Team, with a ramp up RN & RRT model, continues to support the site. The team responded to over 825 Code 66 calls and 1100 follow up visits this past year. The team was instrumental in ongoing assessment and safe transfer of COVID-19 patients to ICU as well as providing support to inpatient unit teams during this time of high capacity and acuity.

Education and Research are essential components of the ICU and our specialty services offer unique and valuable learning experiences. FMC ICU hosts many learners, and continued to do so during the COVID-19 response, throughout the year including undergraduate nursing, Advanced Critical Care Nursing, Respiratory Therapy & Allied Health students along with Medical trainees and Fellows.

Kelly Coutts, FMC Patient Care Manager
Dr. Philippe Couillard, FMC ICU Medical Director
Foothills Medical Centre Cardiovascular Intensive Care Unit (FMC CVICU)

Overview
The Cardiovascular Intensive Care (CVICU) provides high quality care for the post cardiac surgery patients. This can only happen with the amazing dedication, teamwork, and collaboration of all the departments and multidisciplinary teams involved throughout the cardiac surgery patients’ journey. The unit has a total of 22 beds on two separate units (Units 94 and 104) with 16 of these beds currently funded. The Cardiovascular Intensive Care Unit (CVICU) at the Foothills Medical Centre, is the only CVICU serving Southern Alberta with over 1400 cardiac surgery cases in 2021. The CVICU specializes in post-operative open heart surgery with the majority of cases being Coronary Artery Bypass Graft (CABG) and valve repair or replacement. Other post-operative surgeries cared for in the CVICU include complex thoracic aortic surgery, minimally invasive valve surgery including alternate approaches to femoral based Transcatheter Aortic Valve Replacement (TAVR), as well as Extracorporeal Life Support (ECLS) for both temporary heart and lung support (VV/VA ECMO) as well as Ventricular Assist Devices (VAD) which provide short term and more durable heart support.

Patient Care
The CVICU multidisciplinary team, in particular the nursing team, has remained busy. In addition to taking care of post-cardiac surgical patients the team has played an essential role in the care of the COVID-19 patients during the pandemic. In addition to co-managing the COVID-19 patients supported by ECLS in the general systems ICU at FMC, CVICU nurses were deployed to assist with the additional nursing of patients in the general systems ICU or to take care of general systems patients transferred to CVICU. Team members are commended for their hard work, courage and dedication to provide care in many different ways during the pandemic.

The CVICU consists of a large multidisciplinary team:
- 110 Registered Nurses
- CVICU has the highest number of advanced certifications in critical care including IABP, CRRT, three VAD devices, Pulmonary Artery catheters, advanced pacing, Lumbar drains as well as other ICU advanced certifications

Foothills Medical Centre Cardiovascular Intensive Care Unit (FMC CVICU) (Continued...)

- 1 Clinical Nurse Educator
- 10 Cardiovascular Intensivists MD’s
- Seven intensivists have obtained advanced Echocardiography training
- Two Intensivists have additional training in ECLS
- 11 Cardiac Surgeons
- 19 Registered Respiratory Therapists
- 2 Physiotherapists
- 1 Clinical Pharmacist
- Many allied health care providers including Unit Clerks, Health Care Aids, housekeeping staff, social workers

Quality & Improvement
Our dynamic multidisciplinary CVICU team continues work on Quality Improvement and research projects including:
- Relaunch of the Patient Flow Project – Optimizing patient flow from CVICU to cardiac surgery ward Unit 91. The goal is to improve the flow of patients from the CVICU to unit 91.
- Preparation for the SMART-BP study which is going to examine the use of wireless non-invasive real time blood pressure monitoring and compare it to invasive blood pressure monitoring.
- Participation in the Venting Wisely initiative which is a pan-provincial initiative to optimize the care provided to patients who are mechanically ventilated with hypoxemic respiratory failure and ARDS using a multidisciplinary evidence informed care pathway.
- Creation of a high-resolution quality improvement database for patients who are postoperative Cardiac Surgery to try and eliminate unnecessary variability in care.

Education
The CVICU has a very robust, clinically engaged process of educating our nurses. The extensive advanced certifications require initial certification as well as annual recertification provided by the CVICU clinical nurse educator Chris Coltman. All new ICU nurses are part of the Department of Critical Care mentorship program. This program has been customized for CVICU and provides a supportive learning environment to allow nurses to become independent and highly skilled.
Foothills Medical Centre Cardiovascular Intensive Care Unit (FMC CVICU) (Continued...)

The CVICU is heavily involved in a simulation program. The purchase of a specialized mannequin has enhanced the learning experience for emergent post-operative procedures. In addition with the COVID-19 pandemic, extensive simulation of the safe ECLS cannulation of COVID-19 patients using PPE and a new cannulation protocol was undertaken. The simulation involved members of the entire team, including Cardiac surgeons, Cardiac Anesthetists, CV-intensivists, operating room nurses and, anesthesia and non-anesthesia respiratory therapists as well as our multidisciplinary colleagues from the general systems ICU. Simulation in 2022 will be expanded to accidental hypothermia, cardiac catheterization lab, and CVICU ECLS emergencies.

Barb Jones, FMC CVICU Patient Care Manager
Dr. Ken Parhar, FMC CVICU Medical Director

Peter Lougheed Centre (PLC)

2021 COVID-19 response: expanded our 18 bed unit to 36 beds, having 1 ICU located in 2 separate areas. A change in the model of care was required during waves 3 and 4 to more of a team based focus with 1 ICU RN caring for 2 or 3 critically ill patients with the assistance of redeployed staff to the ICU. The surge was medically supported by redeployed residents as well as attending physicians from adult and pediatric emergency medicine, anesthesia and pediatric intensive care. Attending ICU physicians worked additional weeks on service to function as an additional team. ICU also had a team of staff from outside the ICU developed to assist with the significant number of proning required assisting twice a shift in the ICU 7 days a week composed of allied health, staff from other units and PLC leadership team.

Attempts to try to have Connect Care launched at the PLC, were once again delayed due to the impact of the pandemic. Plan for Go live is May 28, 2022.

Patty Infusino, PLC Patient Care Manager
Dr. Dan Niven, PLC ICU Medical Director
Rockyview General Hospital (RGH)

This year, RGH ICU received capital project funding to move ahead with construction of a new combined and expanded ICU/CCU, slated for completion in 2024. We are grateful for this long awaited opportunity to update our space to better support patients, their families, and the dedicated healthcare providers that care for them.

We are pleased to welcome the addition of Nurse Practitioners to the ICU as of December 2021. These advanced providers work alongside our intensivists and medical trainees in a hybrid team model unique to the ICUs in the city.

We continue to support our hospital and ICUs across the city through the pandemic, frequently operating at overcapacity to ensure all critically ill patients receive the care they require.

Our Inter-professional projects remain active, including Enhancing Inter-professional patient care rounds and Arterial line insertions by RTs. We are a high performing site in a number of province wide quality initiatives (such as the ICU Delirium Management and Venting Wisely projects).

Melissa Redlich, RGH Patient Care Manager
Dr. Jessica C. Wang, RGH ICU Medical Director

South Health Campus (SHC)

This past year has been very challenging for the SHC ICU in navigating the COVID-19 pandemic. Twice the unit was required to add more beds outside of the normal bed map requiring overflowing to other care spaces. Once to the PACU when capacity was topped at 22 beds and again in the fall to Day Surgery for the same number of bed spaces. Staff from the hospital and beyond were reassigned or redeployed to assist with patient care. This included for all disciplines; Medical, Nursing, Respiratory, Nursing Attendants, Service Workers, Physiotherapists, Pharmacists and Unit Clerks. Alternative care models were instituted to assist in the care of so many critically ill patients.

The ICU remains a very collaborative team working toward achieving patient care goals. The nursing staff is comprised of all RNs along with Nurse Practitioners, Respiratory Therapists, Nursing Attendants, Service Workers, Unit Clerks, Physiotherapists, Dieticians, Pharmacists, Social Workers and Occupational Therapists. The ICU supports the site with an Outreach Team as well as a Code Blue Team.

Unit Accomplishments
• Planning and implementing care for COVID-19 pandemic patients as well as expected ICU patient populations.
• Providing education to reassigned and redeployed staff members

Future Goals
• Supporting staff to lessen stress and burnout
• Begin work on Connect Care

Rachel Taylor, SHC Patient Manager
Dr. Juan Posadas, SHC ICU Medical Director
Clinical Program Updates

1. Critical Care Network
2. Extracorporeal Life Support Program
3. HRF & ARDS
4. Neurocritical Care
5. Organ & Tissue Donation
6. Outreach Program
7. Nurse Practitioner Program
8. Critical Care Rehab
9. Albumin Project
Critical Care Network

The Department of Critical Care Medicine is a vital part of the Critical Care SCN (CCSCN). Several members of our department provide leadership or vital participation within the CCSCN (Dan Zuege – Senior Medical Director; Dan Niven, Ken Parhar, Kirsten Fiest – provincial project leads; Jeanna Morrissey – CCSCN Manager; Kirsten Robertson, Karen Shariff, Dan Jewers – provincial practice leads; Emma Folz, Dan Niven – Core Team membership; many of our research support staff and trainees). Provincial collaboration benefits our department in many ways, in particular during our COVID-19 pandemic. Some of the key outputs and collaborations of the CCSCN related to COVID in 2021 are illustrated in this image:

- Dr. Dan Zuege, Senior Medical Director, Critical Care SCN

Critical Care Network (Continued...)

Many other key CCSCN provincial initiatives are underway, many led by individuals from DCCM:

- RATIONALE – a program aiming to optimize the use of Albumin in the critically ill. Project Lead - Dan Niven. Funding – CIHR; MSI Foundation. This program, despite the limitations of the pandemic, has completed its full implementation stage and is entering a sustainment phase. This program has demonstrated significant trends to reduced and more appropriate use of Albumin in ICUs in Alberta.

- Venting Wisely – a program aiming to optimize the care of ventilated patients with hypoxic respiratory failure in Alberta ICUs. Project Lead – Ken Parhar. Funding – HIIS (awarded in 2020); CIHR. This program, despite the significant stresses of a pandemic, is nearing the completion of its implementation phase. This program optimizes the care patients with hypoxic respiratory failure receive through rigorous measurement, audit and feedback, education supported by practice leads, and clinical decision support embedded in our information systems, ultimately saving lives, reducing ICU length of stay and healthcare costs.

- Don’t Misuse My Blood – a program aiming to optimize use of blood products (other than albumin) in Alberta ICUs. Project Lead - Dan Niven. Funding – PRIHS (awarded in 2020); Choosing Wisely Alberta. This program, in its early phase, aims to influence practices of transfusion and the ordering of blood tests to reduce the exposure of patients to blood products, contribute to conservation of our scarce blood supply, and reduce healthcare costs.

- Delirium – a well established quality improvement program aiming to optimally prevent, detect and manage delirium in critically ill patients. This program is in its sustainability phase. Ongoing important investigations related to the roles families can play in the detection and prevention of delirium continue, led by Dr. Kirsten Fiest and her team.

Dr. Dan Zuege, Senior Medical Director, Critical Care SCN
Extracorporeal Life Support

Extracorporeal Life Support (ECLS) is a method of life support used in patients with catastrophic cardiac and respiratory failure. It is primarily used to oxygenate and remove carbon dioxide from the blood as well as provide hemodynamic support. ECLS includes veno-venous extracorporeal membrane oxygenation (VV-ECMO), which is used to treat refractory respiratory failure, as well as veno-arterial extracorporeal membrane oxygenation (VA-ECMO), which is used to treat refractory cardiac failure.

ECLS has been provided at the Foothills Medical Center CVICU for several years. During the 2008/2009 H1N1 influenza epidemic there was a renewed interest in expanding the use of ECLS worldwide and also locally. Since then, it has been used increasingly for refractory respiratory and cardiac failure.

In 2015 a multidisciplinary ECLS committee was created to oversee and improve the delivery of ECLS within Calgary. The objectives of the ECLS committee have been to prioritize the provision of this resource intensive modality to those patients most likely to benefit, whilst improving safety and reducing morbidity during ECLS runs. 2016 was the first full year of the formalized ECLS program.

In 2021, almost 30 runs of in ECLS were performed in total (including both VA and VV). In addition, several notable accomplishments were made. We are actively using our new CardioHelp system. These units have improved our monitoring and ease of transport while minimizing risks to the patients such air emboli and clotting.

In 2022, we look to continue our momentum by expanding our training and simulation exercises for the use of ECLS. We are building on our experience with high fidelity simulation during the COVID-19 pandemic and expand that to include cannulation, and ECLS emergencies for non-COVID patients. We will continue to work together with the ECLS programs at the Mazankowski Heart Institute in Edmonton as well as Alberta Children’s Hospital to work on areas of mutual interest such as policy, education and simulation.

Finally, we will continue to put the pieces in place to move towards being accredited by the international Extracorporeal Life Support Organization as a “Center of Excellence” further demonstrating our commitment to providing the highest quality of care for patients requiring ECLS.

Dr. Ken Parhar, ECLS Committee Chair and CVICU Medical Director
Acute Respiratory Distress Syndrome (ARDS) is an inflammatory syndrome of the lungs that results in impaired oxygenation due to non-cardiogenic pulmonary edema. ARDS is associated with a significant morbidity and mortality, and thus prompt recognition and treatment is crucial. Treatments for ARDS that have been shown to reduce mortality include minimizing pressure and volume during mechanical ventilation to prevent ventilator induced lung injury, as well as muscle relaxants and prone positioning.

Previous work by our project team (funded by a QI grant Calgary Zone CMO/Medical Affairs, MSI foundation, and 2017 Critical Care Strategic Clinical Network Seed Grant) demonstrated that ARDS is prevalent within the Calgary Zone and associated with significant morbidity and mortality. We estimate that approximately 10% of all Calgary Zone ICU patients meet full ARDS criteria by the Berlin Definition. This is important because patients with ARDS have a two-fold increase in ICU mortality, with patients in the severe ARDS category demonstrating a mortality rate of 56%. Application of evidence based care interventions is quite variable, particularly in the severe ARDS category. If we extrapolate our Calgary area incidence of ARDS to the province of Alberta we estimate approximately 951 cases of ARDS per year in Alberta, with an average hospital length of stay of 22 days. Given a significant variation in care across the province, this presented an opportunity to reduce unnecessary variability and ensure all patients in Alberta were receiving the right care at the right time.

Using existing ARDS guidelines and most recent evidence, we conducted an expert-panel modified-Delphi Consensus process to determine the optimal evidence-informed management of ARDS. We also externally validated the pathway through a survey that was conducted with enthusiastic response from over 700 clinicians from tertiary, community, and regional ICUs across the province. Finally, we pilot tested the pathway for one year at the Foothills Medical Center ICU (2020) and successfully demonstrated its feasibility and acceptability. Based on this work we were funded by CIHR (through a project grant) and also Alberta Health Services (through a HIIS grant) to scale and spread this pathway across the province. This initiative is called “Venting Wisely” and is a partnership with the Critical Care Strategic Clinical Network. Currently we have implemented in 12 of the 16 remaining ICUs with improvement in use of key practices such as lung protective ventilation and prone positioning. This work is being conducted in a pragmatic cluster randomized stepped wedge trial. Formal clinical outcomes will be assessed at the end of this trial. Focus groups and surveys are being used to conduct a process evaluation. A cost-effectiveness analysis will be conducted at the end.

Many members of the DCCM have a key role in Calgary based project and also the broader provincial based work and include:

- Gwen Knight, Research Assistant, Dr. Andrea Soo, Senior Biostatistician DCCM
- Katie Kissel RN MN CNS, Vanessa Doiron CNE, Michelle Cyca RRT
- Dr Tom Stelfox, Dr Dan Zuege, Dr Dan Niven, Dr Chip Doig, Dr Kirsten Fiest
- Devika Kashyap, DCCM Quality Improvement Consultant

Dr. Ken Parhar, HRF and Venting Wisely Project
Team lead
The Neurocritical Care Service consists of three fellowship-trained and board-certified (United Council of Neurological Sciences) neurointensivists – Dr. Andreas Kramer, Dr. Philippe Couillard and Dr. Julie Kromm – who work alongside a multidisciplinary team. Our vision is exceptional, comprehensive patient and family centered neurocritical care (NCC). Our mission is to advance neurocritical care through clinical, education and research excellence.

Between 15-20% of annual ICU admissions comprise patients with life-threatening neurological disorders. In Calgary and Central/Southern Alberta, this translates into approximately 900 patients per year who are admitted to various ICUs. These patients suffer from a variety of disorders. The average age of all NCC patients is ≈50 years (IQR 33-65). The rate of devastating outcomes (death, coma/vegetative state, or severe disability) varies widely, between ≈20-70% depending on the diagnosis. This high morbidity and mortality, combined with relatively young patients being impacted, results in a large proportion of disability-adjusted life years.

For patients with life-threatening neurological disorders, high quality NCC is a crucial link in their chain of survival and recovery. Our service aims to assist clinical teams with diagnostic workups, preventing and managing secondary neurologic injury and systemic complications of neurologic disorders, providing evidence-based neuro-prognostication and, when appropriate, supporting organ and tissue donation. We offer both in-person and telephone consultations to members of the Departments of Critical Care Medicine, Clinical Neurosciences and Cardiac Sciences. We also provide telephone support when requested for Red Deer Regional Hospital, Chinook Regional Hospital and Medicine Hat Regional Hospital ICUs. We hope to grow our team, develop clinical protocols, and update our equipment in the future, which will further help support NCC patients and the teams providing care for them.

We continue to conduct local research and are collaborating with several other Hotchkiss Brain Institute members to launch a NCC research group. With great support from the DCCM research team, we have continued our involvement in several CIHR-sponsored international research trials, including HEMOTION, SaHaRA, INDEX, and PROTEST trials. We are currently working on launching the NeuPaRT (Neurologic Physiology after Removal of Therapy) study at Foothills Medical Centre. Members of our group are co-investigators for each of these studies. We continue to be involved in several national and international research and guideline committees including the Canadian NCC Society and Canadian Cardiovascular Society position statement on neurologic prognostication post cardiac arrest; the Canadian Critical Care Society, Canadian Blood Services and Canadian Medial Associations Brain-Based Definition of Death Guidelines; and the National Institute of Neurologic Disorders and Stroke Curing Coma Campaign.

We successfully launched our NCC fellowship program this past July 2021 and have welcomed Dr. Ian Schoonbaert as our inaugural fellow. We remain involved in NCC education at both PME and CME levels including past and planned presentations at the annual Neurocritical Care Society meeting and Canadian Neurological Science Federation Congress.

We look forward to ongoing collaborations in the coming year aimed at improving NCC for all those in need.

Dr. Phillipe Couillard, FMC ICU Medical Director
Dr. Julie Kromm, Neurointensivist/Intensivist
Dr. Andreas Kramer, Neurointensivist/Intensivist
Organ and tissue donation are an important component of end-of-life care in the intensive care unit (ICU). Many families of critically ill patients find comfort in knowing that something positive occurred despite their tragic circumstances. A growing number of Albertans have expressed their intent to donate organs and tissues at the end of life via the Alberta Organ and Tissue Donation Registry.

In 2021, we had our highest number of deceased organ donors ever (42 or approximately 19 donors per million population). This included 28 (67%) donors following neurological determination of death (NDD), 6 (14%) following circulatory determination of death (DCD), and 8 (19%) that began as DCD organ donors but then progressed to NDD.

Another development in 2021 was that Alberta Health funded a provincial “Specialist in End-of-Life Care, Neuroprognostication, and Donation” (SEND) program. Most other Canadian provinces have had “Donation Specialist Physician” (DSP) programs for some years. The Alberta SEND program was developed with the recognition that excellence in deceased donation is highly interdependent with excellence in other domains of critical care practice. For example, our DCD program routinely requires a second independent opinion about prognosis before a patient can be considered eligible. As such, the scope of practice needed to provide excellence extends beyond just immediate donation-related concerns.

More than 20 SEND physicians have now been recruited across the province in Calgary, Edmonton, Grand Prairie, Red Deer, and Lethbridge. Within Calgary, there is always a SEND physician “on call” to provide second opinions regarding prognosis, assist with neurological or circulatory death determination, and support donation processes. The SEND program has also initiated a continuous audit of missed donation opportunities and other donation-related metrics, such as consent rate, compliance with donor management guidelines, and use of the provincial registry. The goal is to regularly provide feedback to front line providers for the purpose of continuous quality improvement. Educational seminars and case reviews for physicians and donation coordinators have been occurring approximately every 3-4 weeks. A provincial SEND conference is planned for later 2022 or early 2023.

The Death Prediction and Physiology after Removal of Therapy (DePPaRT) study was published in the New England Journal of Medicine in 2021. Drs. Chip Doig and Andreas Kramer were co-investigators in this seminal work and DCCM enrolled more patients than any other Canadian program. Based on the results showing no resumption of circulation following a maximum of 4 minutes and 20 seconds without pulse pressure, our DCD policy was modified such that death is declared after 5 minutes of circulatory arrest rather than necessarily requiring electrical asystole. This is expected to increase the number of DCD organ donors and the quality of grafts that are transplanted. A follow-up project, the Neurologic Physiology after Removal of Therapy (NeuPaRT) study, has been funded by CIHR, and Drs. Julie Kromm and Andreas Kramer are co-investigators.

Additional important donation research was completed in 2021. The INDex-CTP study evaluated the use of CT perfusion in the diagnosis of NDD. Over 40 out of approximately 300 patients were enrolled in Calgary under the leadership of Dr. Philippe Couillard. Preliminary results were presented at the Canadian Critical Care Forum and multiple publications are expected later in 2022 and 2023.

There were 86 patients referred for ocular and tissue donation in 2021 from Calgary adult ICUs. Because the contraindication list for ocular/tissue donation is much longer than for organ donation, only 13 of these cases resulted in transplantation. We continue to recommend that clinicians call SAOTDP about every death in patients under the age of 80 years to assess whether they might be eligible for tissue donation.

Dr. Andreas Kramer, Medical Director - Southern Alberta Organ and Tissue Donation Program
The provision of high quality critical care within our 5 busy ICUs in the Calgary Zone requires 24/7 on site presence of providers who continuously oversee the complex care needs of this patient population, including responding to rapid changes in physiology which happen frequently and over short time spans. In addition to the care provided to those already admitted to the ICU, an integral, component of our program is a multidisciplinary rapid response (“outreach”) team, comprised of an experienced ICU nurse, respiratory therapist and physician, who respond to urgent medical activation and code blue calls and consult on clinically deteriorating patients on inpatient units. The overriding goal of this team is to improve patient outcomes – either by preventing the need for intensive care (via rapid assessment and appropriate ward-based treatment and decision-making) or by the rapid institution of critical care. ICU outreach physicians are the core physician providers for the ICU outreach teams and are also key tier one providers in all five ICUs from 17:00 to 8:00 hours every night, thus providing mission-critical staffing of our adult ICUs.

As shown in Figure 1, the number of code blue team activations in hospitalized patients outside of our adult ICUs decreased from 387 in 2006 to 242 in 2019, with further decreases during the past two years, despite the dramatically increased number of hospital admissions during the Covid-19 pandemic.
These data highlight the positive impact that our ICU outreach/rapid response team has had in reducing the incidence of inpatient cardiac arrests, despite increasing patient numbers. In addition, as shown in Figure 3, our ICU readmission rate within 72 hours of discharge from the unit has remained below 2.5% during the past year, despite enhanced patient acuity during successive waves of the pandemic.

The specific metrics related to multidisciplinary rapid response calls in calendar year 2021 are highlighted for each of our four non-cardiac ICUs in Table 1. Despite increased patient acuity and volume during successive waves, the time spent at the patient’s bedside has averaged 61 minutes, highlighting the complex care needs of this patient cohort.

At present there are 33 outreach physicians on our rota, who are credentialed family physicians, anesthesiologists, emergency medicine physicians, internal medicine physicians or cardiologists, with additional Critical Care training and experience. We are continuing to recruit highly skilled and motivated practitioners to this mission-critical role.

Dr. Richard J. Novick, Deputy Head (DCCM)
Devika Kashyap, Quality Improvement (DCCM)
Kevin Sedor, Outreach Program Assistant (DCCM)
Nurse Practioner Program

2021 was another clinically challenging year due to the demands of the global COVID-19 Pandemic. The Nurse Practitioners of the DCCM rose to the task of providing direct clinical care for an increasing and challenging patient population, coordinated for surge planning, assisted in supporting and collaborating with volunteer non-ICU physician/learners, and supported the increasing workload and acuity on wards with outreach follow up. The DCCM NPs have also developed and implemented a Critical Care Nurse Practitioner (CCNP) orientation program as well as supported new NP orientees to the department.

Clinically, they have continued to strengthen their abilities with point of care ultrasound competence as augment to the physical exam, have worked to mitigate complications and incidents of central line associated blood stream infections, and have focused heavily on integrating evidence-based practice for treating critical care patients such as with the appropriate use of albumin implementation of the Venting Wisely program. In addition to their clinical responsibilities, the DCCM NPs have continued to focus on research and program development. Highlights include the effectiveness of early cognitive stimulation in the prevention of delirium, exploring integration of advanced care planning in complex congenital heart disease with a patient led focus, and protocol development for integration of NPs in outpatient coarctation clinics. They have also collaborated on projects including a national survey on neuroprognostication practices post cardiac arrest, the impact of rapid redeployment of nurses during pandemic surges, mentorship for newly graduated and student NPs, and ongoing involvement with the ICU follow up clinic.

As the DCCM expands the NP role to all adult ICUs this year, we expect to utilize the CCNP orientation program to support our new team members through mentorship, excellence in procedural competence, ongoing quality improvement, and research. We look forward to further expand the program in the years to come and to establish long lasting collaboration with our interdisciplinary colleagues.

Emma Folz, PLC Executive Director (DCCM)
Charissa Elton-Lacasse, Nurse Practioner (DCCM)

Critical Care Rehab

Outpatients

The Critical Care Recovery Clinic continues to function through the pandemic. The focus of the clinic has shifted primarily to COVID recovery for our patients in the ICU. We continued to run two outpatient clinics each week, but resources have shifted somewhat. Physiatry continues to work in the clinic but Nurse Practitioner resources were pulled back into the units due to the pressure from the various waves. We continue to use existing rehab resources within the city and have established informal working relationships with the respirology covid recovery clinic at RGH (Dr. Kate Skolnik, Respirology).

Inpatients

We have expanded the music therapy program to include two sites in the city (South Health Campus and Foothills Medical Centre ICUs).

Occupational Therapy and Physiotherapy routinely use the RT-300 FES ergometer in the Foothills ICUs. We continue to develop training and best approaches to best support the use of this advanced therapy equipment with our patients in the units.

Research

On the research front, a recent feasibility and acceptability study on music therapy within the unit has been submitted for publication (Dr. Stephanie Plamondon, Physiatry). We recruited patients from the Recovery Clinic to participate in the Canadian COVID-19 Prospective Cohort Study (CANCov) (Local PI: Dr. Sarah Manske, Kinesiology). The ICU Peer Support Group study has closed (Dr. Tanya Mudry, Psychology).

Dr. Chris Grant, Physical Medicine & Rehabilitation (DCCM)
Joanna Everson, Nurse Practioner (DCCM)
De-implementation of Low-value Albumin Fluid Resuscitation in Critical Care – Customized KT during a Pandemic

Overuse of low-value care remains a major threat to providing high quality healthcare. Fluid resuscitation using human albumin is an exemplar low-value care practice. Albumin is a blood product used intravenously to treat patients whose intravascular volume is severely reduced. Evidence has identified a small number of patient populations that derive benefit from use of intravenous albumin, however the vast majority of albumin is commonly prescribed for patients where rigorous science indicates no benefit. The objective of the current study was to reduce low-value albumin use among adults admitted to ICUs in Alberta, Canada.

The RATIONALE (cRitical cAre opTimizatIOn of ALbumin ordEring in Alberta) study was a registry-based stepped wedge quality improvement intervention trial implemented in all 16 adult ICUs in Alberta. Implementation was driven by a team of Calgary investigators and facilitated by collaboration with the Alberta Critical Care Strategic Clinical Network as well as the Physician Learning Program. Clusters of two ICUs began using the intervention every two months until all 16 ICUs were using the intervention. The quality improvement intervention targeted established barriers and facilitators and was co-developed by a multi-disciplinary working group and consisted of: 1) identifying clinical champions in each ICU; 2) targeted and tailored education to prescribers and bedside nurses; 3) changes to the way in which albumin was ordered; and 4) bi-monthly unit-level audit and feedback. Data was obtained from eCritical, the provincial electronic medical record and data registry for all ICUs. The primary outcome was the proportion of patients without an evidence-based indication for albumin who received at least one unit of albumin during ICU admission. Secondary outcomes included the number of albumin prescriptions per patient that received any albumin, and the amount of avoided biomedical waste.

Intervention implementation began with the first cluster of ICUs in November 2019. The final ICUs were brought onboard January 2021. COVID-19 interrupted implementation by six months between March and August 2020, and delayed audit and feedback by another 6 months in 2021. Among the 16 participating ICUs, the proportion of patients without an evidence-based indication for albumin who received at least one unit of albumin during ICU admission decreased from 12.9% at baseline to 8.7% as of October 2021 (relative decrease 32.7%). This resulted in 649 patients avoiding unnecessary exposure to a blood product.

The number of albumin prescriptions per patient did not change considerably compared to baseline (4.0 versus 3.9), however owing to a reduction in use of the glass bottles used to store albumin, 1416kg has been prevented from entering biomedical waste. Among the 5 ICUs from Calgary, a low baseline utilization of 7.5% of admissions decreased to 6.0%, a relative decrease of 19.2%.

A targeted and tailored, multifaceted quality improvement intervention resulted in considerable reduction in low-value albumin use among patients admitted to adult ICUs in Alberta. Pandemic-related strain significantly hampered timelines associated with planned non-pandemic quality improvement work. Additional work to sustain the observed change in practice is ongoing.

Dr. Dan Niven, PLC ICU Medical Director
Informatics plays a vital role in the delivery of and planning for excellent critical care in Calgary. We are fortunate to have robust clinical information systems, data repositories and clinical analytics resources and teams to support us in our daily work. These include:

Connect Care – planned implementation to Calgary critical care in May 2022 at PLC, November 2022 at FMC, RGH and SHC in 2023. Numerous planning activities are underway with active unit engagement. Device and wifi upgrades are complete as is the installation of tap and go computer access. Area trainers and superusers are busy training end users for the PLC ICU implementation. Fortunately, many of these individuals can support Launch 5 at FMC. The Connect Care Critical Care Area Council and its adult subgroup have significant Calgary leadership (Emma Folz, Dan Zuege) and representation.

The eCritical Alberta Program – supports the MetaVision bedside Critical Care Information System in all ICUs in Alberta since 2012 (now being replaced by Connect Care) and the TRACER data repository and clinical analytics system. As our core CIS in our ICUs, MetaVision provides detailed electronic clinical, device and laboratory data to support daily care of critically ill patients. This data, supplemented with other data sources, allows the TRACER analytics system and team to provide near real-time summary operational, quality and performance data to support optimal care delivery and planning. Adaptations to MetaVision and several new analytics tools were quickly made available to understand the evolution of COVID in ICUs from a utilization and outcome perspective. The vital importance of a critical care focused informatics team, with knowledge and skill with both the clinical and informatics aspects of critical care in Alberta, independent of the information systems in use, cannot be overstated.

Looking forward, the importance of excellent informatics resources will only be growing to support the drive for quality, appropriate, cost effective care. Our department looks forward to the continued evolution of our informatics assets to enhance our measurement of quality of care at department, unit and provider levels.

Dr. Luc Berthiaume, Medical Informatics Lead for Critical Care, Calgary Zone
Quality Assurance & Patient Safety

Patient safety culture starts with awareness and readiness to review safety events in a timely and just manner. The DCCM Patient Safety Roadmap summarizes how we learn about safety events in our department, as well as how we respond when serious safety events occur. The Reporting and Learning System (RLS) reports and the zonal Mortality Working Group (MWG) reviews are important forums for how we learn about and discuss safety events.

Quality Assurance & Patient Safety

Here are some cases and outcomes from the 2021 year driven by RLS and MWG:

1. Best Practices for Multidisciplinary ICU Rounds
   With many active points of communication with team members, a medication was ordered on the wrong patient during ICU rounds. This resulted in a Quality Assurance Review (QAR) that led to an ongoing QI project to standardize communication flow and improve role clarity for best rounding practices.

2. Advanced Temperature Monitoring for at Risk Patients
   In 2020, several cases submitted via RLS highlighted a discrepancy between external temperature versus internal temperature monitoring devices and was shared at the zonal MWG. After an extensive review by a working group comprised of our CNS/CNE teams, Dr. Niven and the ICU executive, a critical care standard of practice was developed by way of an algorithm for temperature management and manipulation using core temperature monitoring.

3. Partnership with Cardiology for High-Risk Transfers
   The transfer of sick patients for off-site procedures requires clear communication between multiple providers so the most responsible physician and care team have the relevant information. ICU and cardiology QI leadership have partnered to facilitate these complex transfers with assistance from RAAPID.

4. Contact Lens Screening
   The presence of contact lenses can be difficult to detect in critically ill patients and information about visual aids is often not known at the time of ICU admission. A practice support document is soon to be released that summarizes work that was completed on defining and implementing standardized timing for contact lens screening, assessment and documentation by the ICU care teams.
Quality Assurance & Patient Safety (Continued...)

5. Foley Trauma Prevention
Multiple RLS reports have demonstrated that Foley Trauma is a common injury. An environmental survey of incidence showed that incomplete Foley insertion prior to inflating the balloon as the preventable component of the injury pattern. This important reminder was shared with our ICU teams via our Patient Safety Memos.

6. Neuromonitoring Education
A 2020 meningitis case highlighted opportunities to increase staff education on caring for patients admitted with neurologic diagnosis. In 2021 a neuro assessment video was disseminated to highlight basic best practices neurological assessment for critical care nurses, and how to differentiate between normal and abnormal findings, including emergent assessment findings for immediate intervention. Thank you to Emily and Laura, FMC ICU CNEs, and Katie, CNS, for contributing to this education effort!

7. Collaborated with Other Quality Assurance Committees (QACs)
Much of our QAC’s safety work involves contribution and collaboration with other QACs and departments across the zone. Examples include but are not limited to: Identification of a difficult airway patient and communicating this information in future encounters (Medicine QAR), documentation of wound packing in collaboration with the surgery, wound care, and electronic health records (DCCM QAR), and optimizing paramedic use of needle decompression (EMS Consult).
Quality Assurance & Patient Safety (Continued...)

8. Safety work to come

Despite the demands COVID has placed on our system and department, the DCCM continues to identify and engage in extensive patient safety work. In the upcoming months we will see completion of QARs for a food allergy, mental health, environmental safety, and updates to practice guidelines for tracheostomy change.

These practice changes are all generated by frontline communication. Thank you for your contribution to safer care!

Dr. Selena Au, QAC Co-Chair & QI Medical Director
Emma Folz, QAC Co-Chair & Executive Director
Dr. Dan Zuege, Department Head DCCM
Tracey Receveur, Patient Safety Lead
Katie Kissel, Clinical Nurse Specialist
Alan Sutton, Respiratory Therapy Lead
Kelly Coutt & Dr. Paul Boiteau, FMC Representatives
Patty Infusino, Dr. Luc Berthiaume, Dr. Kevin Solverson, PLC Representatives
Melissa Redlich & Dr. Frank Warshawski, RGH Representatives
Rachel Taylor & Dr. Selena Au, SHC Representatives
Miranda Kavalench, Administrative Support
Quality Improvement

The culture of Quality Improvement (QI) is integral to the strategic direction, planning and operations for the Department of Critical Care Medicine (DCCM). In the last year, there were two main areas of focus for the QI Portfolio; preparing for the Accreditation Canada survey and putting the final pieces on the Quality Management Framework and Performance Metrics.

Quality of Culture

Quality Improvement (QI) is integrated and considered in all aspects of Critical Care clinical operations and supporting processes. The QI portfolio is one small component of the broad scope of QI work that occurs across the department; QI methodology essentially touches all aspects of care and operations - a guiding principle towards the mission of continuous improvement in patient care.

In the last year, there were three main areas of focus for the QI Portfolio: planning and reporting for ICU-related pandemic operations; road testing the appropriateness of updated performance metrics for department operations; and completing a safety project related to contact lens screening, detection and removal in the ICU setting.
Quality Improvement (Continued...)

Pandemic Reporting
Over the last year, our regular ICU operations pivoted quickly and deftly to support our critical care teams with the pandemic response. A small but mighty role included sharing daily data with our critical care teams and health system as a whole in order to make short-term adjustments and longer term plans to manage acuity and capacity. The DCCM leveraged its robust data and reporting infrastructure to adapt to providing our teams with timely and up to date information in a rapidly changing environment.

Quality Improvement (Continued...)

DCCM Performance Metrics
The DCCM has a long history of using data as a foundation to discuss and drive improvement work for our ICU teams.

E-critical provides us with an extensive dashboard of metrics which has detailed and timely access to numerous data points. A curated list of performance metrics were chosen to review over time and identify possible areas for improvement for ICU Executive and beyond.

This list of metrics was shared regularly this past year to determine appropriateness and plan for broader dissemination. The ultimate hope is that these metrics will be the foundation upon which our ICU teams can focus QI priorities that benefit our patients most.

Contact Lenses in the ICU
In critical care, there are challenges in knowing the contact lens status for patients due to patient status and eyes being closed for extended periods of time. To address this and prevent potential serious adverse events, the DCCM developed a process with supporting practice support document and education for the screening, assessment, detection and removal of contact lenses for ICU patients.

Devika Kashyap, Quality Improvement (DCCM)
The Department of Critical Care Medicine (DCCM) at the University of Calgary has been lucky to have trained adult Critical Care Medicine (CCM) physicians for 33 years. The Royal College of Physicians and Surgeons fully accredited our CCM Training Program for seven years in February 2015. In 2019 we also underwent a successful mid-point internal accreditation process through Postgraduate Medical Education (PGME) at the University of Calgary. Physicians who have graduated from our Training Program have gone on to practice in a variety of both tertiary and secondary centers across Canada and the United States and have helped to shape the modern practice of CCM, not just as clinical leaders but as administrators, researchers and educators in their respective centers.

Presently, there are eight trainees in our CCM Training Program from a variety of base specialty backgrounds (e.g., Internal Medicine, Nephrology, Respiratory, Cardiology and Emergency Medicine). We continue to provide entry positions for four trainees each year with a guarantee of two years of funding. Recruitment was once again highly successful this year with four applicants from across Canada choosing to pursue CCM training at the University of Calgary. Over the years the Training Program has built a solid national reputation, if one trusts the fact that we have witnessed increasing numbers of external applicants and that we consistently match into all our offered training positions. The quality of our program is underscored by the results of our graduating trainees on their national licensing exams—all 4 graduating trainees were once again successful in attaining their FRCPC designation in CCM this past fall.

In July 2019 we implemented a once-in-a-generation change in our educational paradigm by transitioning to a competency-based medical education (CBME) model. This Royal College initiative called “Competence by Design” (CBD) has been the biggest change in postgraduate medical education in Canada in more than three decades! CBD is an outcomes focused physician education model to better support continuous learning and assessment in professional development.

Over the past years several of our faculty members have been engaged in meetings at the Royal College in Ottawa and served in a leadership capacity in this regard within the University. The product of these workshops was delineation of required training experiences, development of new training requirements organized around a framework of enabling competencies, as well as the incorporation of new workplace-based assessment methods that have informed the education and professional development for our current cohort of CCM trainees. Experience to date with the new paradigm has been positive and has afforded our trainees and clinical faculty greater hands-on experience with workplace-based observation, feedback, and coaching in the moment. We remain excited about this transformational educational change and are actively furthering education scholarship exploring our experience with the transition to, and lived-experience of, this new educational paradigm.
**Education Curriculum**

In addition to outstanding clinical patient care opportunities afforded at the University of Calgary, we continue to strive to improve and grow our formal educational curriculum for CCM trainees. Notable aspects include: a weekly core content curriculum, monthly journal club, monthly morbidity and mortality working group, monthly clinicopathological correlation, multi-professional high-fidelity simulation as well as weekly city-wide grand rounds.

Our core content curriculum covers the foundational expertise required of a CCM specialist across all CanMEDS domains. Educational sessions as part of the core content curriculum are provided by a combination of Departmental attending physicians and local experts and are designed in a small-group, interactive format to maximize participation. Our residents also continue to participate in a variety of PGME-sponsored workshops, including sessions on Teaching Techniques and Provision of Feedback as well as Biomedical Ethics and Medico-Legal aspects of practice.

**Continuing Professional Development**

High caliber citywide CCM Grand rounds continue to be a weekly staple as part of our continuing professional development. A variety of local and national experts continue to offer state of the art topic reviews and cutting edge talks on the science of CCM as part of our CME offerings. These are recorded and archived along with the presentation slides. Both are available for review on our website.

**MDSC Program**

Believing that we needed to continuously “raise the bar” in critical care education, a Critical Care MSc/PhD graduate training program was developed nearly two decades ago within the University of Calgary Department of Medical Sciences to better support departmental academic activities. It offers MSc/PhD graduate students and CCM residents a structured educational environment to further their academic pursuits.

The program offers a tremendous amount of flexibility to allow training in diverse areas related to Critical care. The program currently offers 3 graduate courses: The Fundamental Basis of Critical Illness (MDSC 623.02) and Basic Pulmonary and Ventilator Physiology (MDSC 623.03) and Advanced Pulmonary Physiology (MDSC 623.04). Many graduate students have successfully trained in this MDSC subspecialty training program pursuing advanced graduate MSc and PhD degrees.

Students enrolled in the program are expected to present their basic science and clinical research at local, national and international conferences and many students have published their research in well-respected, peer-reviewed scientific journals. The program requires students to have a supervisor who is a member of the Department of Critical Care as well as a supervisory committee that may be made up of diverse members within the University.

For further information about the Critical Care Medicine Graduate Program please contact Aggie Chan, MDSC Graduate Program Administrator, Graduate Sciences Education in the Cumming School of Medicine at medgrad@ucalgary.ca or Dr. Brent Winston, Graduate Coordinator, Critical Care Graduate Program at bwinston@ucalgary.ca.
Several curriculum innovations have been implemented in recent years as well. Our didactic and hands-on curriculum on application of ultrasound and echocardiography in the ICU continues to mature. State of the art on-line educational modules to augment the didactic and practical experiences as part of the curriculum have been implemented since 2016. Since then, a novel IT solution enabling image archiving of ultrasounds acquired at each of the various sites in the city is being implemented to facilitate expert feedback on image acquisition and image quality. Four hand-held ultrasound platforms continue to be accessible to our trainees to allow them to more easily be able to develop their echocardiography skills at the point of care.

More recently, clinicopathological case rounds (CPC) rounds have been developed as a new curriculum innovation to have a forum to improve clinical reasoning skills. These monthly rounds are a joint educational activity between the DCCM and the Division of Anatomic Pathology / Department of Pathology & Laboratory Medicine to provide multidisciplinary teaching around interesting presentations of common diseases, common presentations of uncommon diseases, or otherwise diagnostically and therapeutically challenging disease presentations in critically ill patients. These rounds have been extremely well received by participants and will continue for the foreseeable future due to the high-quality teaching and learning opportunity they afford us.

Two additional important curricula continue to grow, serving to nicely round out our educational offerings. A novel communication skills curriculum that explores fundamental aspects of effective communication including goals of care discussions, addressing conflict and disclosure of unanticipated medical events has been implemented relying on simulated patients to allow CCM residents to grow their skills. Recognizing the increasing importance for physicians to develop comfort and fluency with Quality Improvement and patient safety (QIPS), we have also developed a QIPS curriculum to familiarize our trainees with foundational concepts and to help them develop skills necessary to lead QIPS projects in their future careers.

To further enhance our clinical and academic collaboration with our referring rural centers, the Training Program continues to integrate a one-month community-based rotation at the Red Deer Regional Hospital intensive care unit. This year several of our fellows participated in this rotation supported by the Distributed Learning and Rural Initiative (DLRI) Program offered by the University of Calgary.

The educational experience and professional development afforded by this rotation has been universally highly regarded and immensely valued by our trainees. We’re appreciative of our Red Deer colleagues for fostering such a great experience for our trainees as well as the supports put in place by DLRI to make these learning experiences possible.

In addition to the CCM Training Program, the DCCM continues to support undergraduate and post-graduate medical education at the University of Calgary. The DCCM supervised approximately 150 months of CCM training for rotating residents this past academic year.

Rotating residents came from the following core programs: Internal Medicine, Respirology, Cardiology, Neurology, Emergency Medicine, Anesthesia, General Surgery, Orthopedic Surgery, Plastic Surgery, Otolaryngology, Cardiac Surgery and Urban and Rural Family Medicine. There is no national requirement for CCM rotations in Family Medicine but given that many trainees subsequently practice in rural Alberta, a one-month rotation is offered for all trainees in order to develop skills in caring for the critically ill.

We are pleased to report that our clinical rotation continues to be highly desired by undergraduate medical students at the University of Calgary. The number of medical students who have chosen CCM remained high in 2021. Based on requests for the upcoming academic year, interest in CCM rotations from medical students remains strong.
**Clinical Scholar Program**

2021 witnessed the reinvigoration of a Clinical Scholar Program for the DCCM and a renewed commitment by the Department to sustaining it long term. A scholarship opportunity has been made available to Canadian-trained Critical Care Medicine (CCM) physicians who desire additional specialized training in anticipation of an academic CCM career.

This academic opportunity allows for 12 to 48 months of protected time to complete academic pursuits relevant to the field of CCM. The program allows for the Clinical Scholar to pursue a higher degree (M.Sc. or Ph.D.) as part of the academic component of the Clinical Scholar role or additional sub-specialized fellowship training relevant to the practice of CCM. To support additional academic training, Clinical Scholars are provided the opportunity to work a limited number of locum physician weeks within the Calgary Zone of Alberta Health Services.

The successful completion of the Program is an important pathway of individual professional development and career advancement for Canadian trained CCM specialists after their base training. It’s also an important way that the DCCM contributes to the development of subspecialized national CCM expertise and advances the science of caring for the critically ill.

**Neurocritical Fellowship Program**

The DCCM was thrilled to develop and launch a neurocritical care fellowship program this past year at the University of Calgary. Recognizing the paucity of opportunity within Canada to obtain subspecialized training in caring for neurologically injured patients, the DCCM has responded by developing a structured, competency-based fellowship opportunity.

Spearheaded by Dr. Julie Kromm and neuro-intensive care colleagues Drs. Andreas Kramer and Philippe Couillard this comprehensive training opportunity has come to life welcoming our first fellow in July 2021. We anticipate one position available on a yearly or biannual basis going forward. This will help grow both local and national expertise in neurocritical care and meaningfully impact patient care in centers across Canada.

**COVID-19 Pandemic**

Finally, the COVID-19 pandemic has once again made 2021 an indelible year with far reaching impacts experienced across all facets of the Education Office’s endeavors. Many of our trainees have experienced the disappointment of having to cancel their outbound electives due to necessary PGME restrictions on travel outside our institution. Conversely, we’ve not been able to welcome as many visiting trainees as we might like to Calgary. Many of our ICU fellows were once again recalled to home service in the ICU to meet surging patient care needs because of the pandemic.

Simultaneously, the DCCM also benefitted from the “can-do” attitude of other Departments whose trainees volunteered to redeploy to help out during several waves of COVID-19 pandemic surges impacting the ICU. For this assistance we are extremely grateful.

Given the requirement to socially distance our educational offerings have necessarily also had to adapt and have been reimagined in new ways. Our curriculum has had to move to an online format leveraging Zoom. We successfully hosted our second virtual CaRMS interviews as well. We’re hopeful to see the pandemic subside to resume our usual standard of in-person learning opportunities in the months ahead.

In closing, we would like to recognize and celebrate all our trainees who have risen to the occasion time and time again in providing high quality care amidst a very busy, once-in-a-generation, public health emergency. It is an absolute privilege to work shoulder to shoulder with them. Their resolve and commitment have not gone unnoticed and are hugely appreciated during a time of immense challenge.

We’re all looking forward to brighter days that lie ahead!

**Dr. Jonathan Gaudet, Critical Care Medicine Education Program Director**
Clinical Research

The goal of our Department is to lead and partner in research initiatives to develop and implement new knowledge to provide the best care for critically ill patients. Our Department has much to celebrate and notable research highlights are summarized as follows.

Critical Care Clinical Research

Despite the tremendous challenges of the COVID-19 pandemic, clinical research continued to thrive and achieve new heights in the DCCM in 2021. Pandemic-related limitations required non-COVID research studies to be paused during the first 2 months of 2021, but through remarkable efforts and collaborations, clinical research remained fully operational for the remainder of the year including through the 4th and 5th waves of COVID surges. A remarkable total of 469 patients were enrolled in 16 different studies in ICUs across the Calgary zone in 2021.

2021 saw a continued focus on COVID-19 research in DCCM. Highlights of DCCM COVID research included the completion of enrollment for the COVI-PRONE trial, a large CIHR-funded randomized controlled trial led by Dr. Ken Parhar, as well as 2 major COVID-19 pathogenesis/biomedical research studies led by Drs. Yipp and McDonald. Dr. Yipp’s study of single cell transcriptomics of neutrophils in COVID-19 patients was published in the prestigious journal Nature Medicine.

In addition, non-COVID clinical research also continued to thrive in 2021. Recruitment was completed for the clinical trials RE-ENERGIZE (site PI Dr. Stelfox) and INDEX (site PI Dr. Couillard), for which Calgary was a major contributor to total recruitment. A number of new trials were initiated in 2021 including REMAP-CAP and REVIVAL (PI Dr. Doig) which will continue recruitment in the coming years.

DCCM members achieved ongoing success in obtaining significant research funding in 2021 (NPA/PI >$3M, CO-I >$11M), including CIHR project/operating grants (Fiest (3), Stelfox (3), Kubes/McDonald (1)) and CFI infrastructure grant (McDonald). In addition, CCRN funding was secured that will allow the DCCM to hire 2 additional clinical research assistants in 2022 to help expand the ICU research portfolio at RGH and SHC.

Dr. Braedon McDonald, Interim Director of Research and Innovation (DCCM)
Critical Care Graduate Program - MDSC Program

Several years ago, a Critical Care MSc/PhD graduate training program was developed within the University of Calgary Department of Medical Sciences to better support departmental academic activities. It offers MSc/PhD graduate students and CCM residents a structured education environment to further their academic pursuits.

The program offers a tremendous amount of flexibility to allow training in diverse areas related to Critical Care. The program currently offers 3 graduate courses: The Fundamental Basis of Critical Illness (MDSC 623.02) and Basic Pulmonary and Ventilator Physiology (MDSC 623.03) and Advanced Pulmonary Physiology (MDSC 623.04). Many graduate students have successfully trained in this MDSC subspecialty training program pursuing advanced graduate MSc and PhD degrees. Many Critical Care trainees have augmented their training by getting an advanced degree in the MDSC Critical Care program. Students enrolled in the program are expected to present their basic science and clinical research at local, national and international conferences and students are expected to published their research in well-respected, peer-reviewed scientific journals.

The program requires students to have a supervisor who is a member of the Department of Critical Care Medicine as well as a supervisory committee that may be made up of diverse members within the University.

For further information about the Critical Care Graduate Program please contact Aggie Chan, MDSC Graduate Program Administrator, Graduate Sciences Education in the Cumming School of Medicine at medgrad@ucalgary.ca or Dr. Brent Winston, Graduate Coordinator, Critical Care Graduate Program at bwinston@ucalgary.ca.

Winston Lab Highlights

Dr. Winston continues to be active in research administration in the DCCM as the Coordinator of the Critical Care Graduate Program (a subspecialty within the Medical Sciences Graduate Program) and sits on the Graduate Educational Committee of the Medical Sciences Graduate Program. Dr. Winston also coordinates 2 of the three graduate courses in the Critical Care Graduate Program and is on the GEC of the DCCM.

The Winston lab has been actively involved in examining how metabolomics can be used for diagnosis, prognosis and determining mechanisms of disease in acute respiratory disease syndrome (ARDS) and in traumatic brain injury (TBI), with the goal of applying precision medicine in these disease processes. Currently, Dr. Winston is examining metabolomics of Covid-19 pneumonia and ARDS and is planning to examine the Covid-19 Variants of Concern. As part of Dr. Winston’s research team, Dr Winston is working with Mohammad Banoei (who just finished his PhD and is doing metabolomics in Dr. Ian Lewis’ lab. He has had 2 summer students and has a new graduate student starting in his lab). He works closely with Dr. Chel Hee Lee in biostatistics in the DCCM.

Dr. Winston has been working closely with the ARBs Corona Group over the last year on Covid-19. The Winston team has published 8 publications over the year and has received 5 grants – two as PI (ALA and VPR Catalyst Grant) and 3 CIHR grants as co-I or collaborator. His team has been involved in Clinical trials involving sepsis, Covid-19 and ARDS. Dr. Winston was an invited presenter to the Aspen Lung Conference in September 2021. His presentation was entitled “ARDS heterogeneity from a metabolomics perspective.

Three noteworthy publications are:


3. Mohammed, Yassene; Goodlett, David; Cheng, Matthew; Vinh, Donald; Lee, Todd; Mcgeer, Allison; Sweet, David; Tran, Karen; Lee, Terry; Murthy, Srinivas; Boyd, John; Singer, Joel; Walley, Keith; Patrick, David; Quan, Curtis; Ismail, Sara; Amar, Laetitia; Pal, Aditya; Bassawon, Rayhaan; Fesdekjian, Lara; Gou, Karine; Lamontagne, Francois; Marshall, John; Haljan, Greg; Fowler, Robert; Winston, Brent; Russell, James for ARBs Corona I. "Longitudinal Plasma Proteomics Analysis Reveals Novel Candidate Biomarkers in Acute COVID-19". The Journal of Proteome Research, 2021. DOI 10.1021/acs.jproteome.1c00863. https://doi.org/10.1021/acs.jproteome.1c00863

In response to the COVID-19 pandemic, Dr. McDonald’s research team expanded their interest in immunity, microbiology, and systems biology to investigate COVID-19 pathogenesis in the ICU, in addition to their ongoing work on microbiome-immune interactions in sepsis and critical illness. Selected 2021 highlights include:

1. The McDonald, Yipp, and Kubes labs conducted a collaborative study on the immunopathogenesis of COVID-19 ARDS, with a focus on the impact of neutrophil dysfunction. With the support of 2 CIHR COVID-19 operating team grants, this study identified a pathological shift in the immune system driven by hyperactivated neutrophils in patients with COVID-19. Furthermore, this signature of neutrophil hyperactivation escaped conventional treatments, revealing a new target for further therapeutic development. Their findings were recently published in JCI Insights (Panda et al. JCI Insights 2022).

2. In collaboration with Dr. Justin Chun (Department of Medicine, Division of Nephrology) Dr. McDonald and colleague published a report on post-mortem molecular diagnostics to identify SARS-CoV-2 infection in a renal transplant recipient. Their publication described the first case of fatal COVID-19 in Calgary (FMC ICU), and is also presumed to be one of the first in Canada (Simms EL et al. Am J Transplant 2021).

3. Recognizing the high rates of blood clotting complications in patients with severe COVID-19, Dr. McDonald teamed-up with Dr. Prism Schneider (Department of Surgery, McCaig Institute) and Dr. Ben Gershkovitch (ICU Fellow) to conduct a prospective and longitudinal study of blood coagulation function in COVID-19 ARDS. Using point-of-care testing (thrombelastography) to track coagulation function over the course of each patient’s ICU stay, it was discovered that ICU patients had profound, and sustained hypercoagulability driven by platelet dysfunction. Dr. Gershkovitch presented the study findings at the 2022 ASCIP trainee symposium and was awarded the prize for best oral presentation, and is currently preparing a manuscript for publication.

4. In a study led by Dr. Michael Chiu (ICU fellow) and supervised by Dr. McDonald, the immunological impact of heat shock proteins and HSP auto-antibodies was investigated in patients with COVID-19 ARDS compared to ARDS caused by bacterial pneumonia. Striking differences in the levels of pro-inflammatory HSP and anti-HSP autoantibodies were identified in patients with COVID-19 ARDS, and were associated with the systemic inflammatory response (‘cytokine storm’) in these patients. Drs. Chiu and McDonald are currently preparing a manuscript for publication.
McDonald Lab 2021 Highlights (Continued...)

5. In addition to new COVID-19 research, the McDonald lab had a productive year of research in their main areas of interest of immunology and microbiome in sepsis and critical illness (Changirwa, et al. Cancers 2021; Zucoloto AZ et al. STAR Protocols 2021; Zhang M et al. Crit Care Explor 2021; Mendelson AA et al. Intensive Care Med Exp 2021).

6. New graduate students Jared Schlechte, Diana Changirwa, and Breenna Dobson joined the McDonald lab.

7. Zdenka Slavikova (clinical research coordinator) joined the McDonald team to support these (and other) clinical-translational research studies in the ICU.

Parhar Lab 2021 Highlights

Actively Funded MAJOR Projects

- Implementation Science and Cluster Randomized Stepped Wedge Trial. (TheraPPP study implementing the “Venting Wisely” pathway in all adult Critical Care studies. In this study, Ken in partnership with the Critical Care Strategic Clinical Network is implementing a care pathway for patients who are mechanically ventilated. This project uses an implementation science based strategy to adopt this pathway. The pathway was piloted successfully in 1 ICU and currently actively implementing in all 17 adult ICUs in the provinces as a stepped wedge cluster randomized study. This work has been funded by CIHR (KP-NPA) and Alberta HiIS funding (KP – NPA)

- Awake Prone Positioning for COVID respiratory failure. Ken has co-led (with Jason Weatherald Edmonton and Waleed Alhazzani McMaster) an international multicenter RCT looking at the role of awake prone positioning for patients with COVID-19. As supportive work, Ken was the senior author on a Calgary based case series, as well as Rapid Review on this topic. Ken was also one of the principal applicants on successful CIHR funding for this trial. In total 92 patients of the total 400 were recruited from Calgary ICUs and Covid wards. This work is currently under revision at a top tier general medical journal. He is currently leading a systematic review and has also been invited to help write a Rapid Practice Guideline from the Journal Intensive Care.

Collaborative Projects

Ken is a co-applicant and co-investigator on several CIHR based project grants from within the Department of Critical Care (Stelfox – Accelerate and Fiest – COVID family), as well as outside DCCM (Muruve – Inflammation). In addition, he has an expanding role in multiple national and international collaborations including being a steering group/CIHR co-applicant on several respiratory failure projects including the use of helmets and non-invasive ventilation (HONOUR, Scales Sunnybrook), and Dual Lumen catheters for ECMO (Fan, TGH). Most recently he has been invited to be on the steering group for a large international platform trial (PRACTICAL) for respiratory failure interventions being led by the University of Toronto. This will provide Calgary the opportunity to play a key role in likely future landmark Critical Care trials which will include re-examining the role of steroid in ARDS and also the role of Driving Pressure.
Parhar Lab 2021 Highlights (Continued...)

**Notable Presentations**
In 2021, Ken was invited present both at the Canadian Critical Care Forum as a speaker to provide a presentation on Mechanical Power and was faculty at the Canadian Critical Care Review Course and gave a lecture on ARDS.

**Team Members**
He currently works with a team of 7 (3 hired research assistants as well as 4 KT practice leads) in addition to multiple multidisciplinary team members. Most recently Ken has taken on his first Graduate Student Committee membership for a MSc student in Community Health Sciences.

**Notable Publications**

Biomedical - Craig Jenne

The Jenne Lab had 10 papers in published in 2021 including 2 reviews, 6 collaborations and 2 primary research papers. Collectively these works focus on the role of inflammation in the host response to both infectious and non-infectious disease conditions and include multiple clinical studies assessing the efficacy of vaccination, the measurement of biomarkers after brain injury and mapping biomarker profiles during appendicitis in a pediatric population. In addition, we received two CIHR priority announcements to use intravital microscopy to study animal models of viral infection and were successful in a team application to build a Canadian Hepatitis B Virtual Centre of Excellence. The Jenne lab has also been engaged in public outreach with regards the ongoing COVID-19 pandemic, participating in more nearly 400 local, national, and international media interviews in 2021 and contributing to numerous public lectures and panels on viral spread and vaccines.

Paul Kubes

Dr. Paul Kubes has helped the Vice President of Research of the University of Calgary write a Biosciences Research Infrastructure Fund CFI for $13 million to expand the level 3 facility so that we can do more than just COVID research but also study TB and other pathogens. We obtained 3 additional CIHR grants: one looking at COVID variants of concern together with Dr. Braedon McDonald and two examining liver injury and lung infections. We have published with Dr. McDonald a study examining neutrophils from COVID patients and, in addition, a study in the cancer field. Most exciting is that L-SALT, an inhibitor of neutrophil recruitment into lungs discovered in Calgary, has now made it to Phase 3 clinical trials in COVID-19 patients.
## Current DCCM Clinical Studies

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## On-going Enrolment - Calgary Zone

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## Book Chapters 2021 / Patents 2021

### Patents 2021

### 2021 Supervised Research Trainees

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<td>Dr. Braedon McDonald</td>
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<tr>
<td>2. Kathryn Strayer, Undergraduate Project Student</td>
<td>Dr. Braedon McDonald</td>
</tr>
<tr>
<td>3. Amanda Zucoloto, PhD Student</td>
<td>Dr. Braedon McDonald</td>
</tr>
<tr>
<td>4. Jared Schlechte, MSc Student</td>
<td>Dr. Braedon McDonald</td>
</tr>
<tr>
<td>5. Diana Changirwa, MSc Student</td>
<td>Dr. Braedon McDonald</td>
</tr>
<tr>
<td>6. Breanna Dobson, MSc Student</td>
<td>Dr. Braedon McDonald</td>
</tr>
<tr>
<td>7. Gabriela Quiroz-Olguin, PhD</td>
<td>Dr. Braedon McDonald</td>
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<td>8. Chris Connors, PhD Student</td>
<td>Dr. Braedon McDonald</td>
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<tr>
<td>9. Benjamin Gershkovich, MD, FRCPC</td>
<td>Dr. Braedon McDonald</td>
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<tr>
<td>10. Michael Chiu, MD, MSc, FRCPC</td>
<td>Dr. Braedon McDonald</td>
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<tr>
<td>11. Simon Guienguere (Doctoral candidate)</td>
<td>Dr. Chip Doig</td>
</tr>
<tr>
<td>12. Amanda Leong, MSc candidate</td>
<td>Dr. Chip Doig</td>
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<tr>
<td>13. Laurie Lee, Doctoral Candidate</td>
<td>Dr. Chip Doig</td>
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<tr>
<td>14. Ian Schoonbaert</td>
<td>Dr. Julie Kromm</td>
</tr>
<tr>
<td>15. Erica McKenzie</td>
<td>Dr. Julie Kromm</td>
</tr>
<tr>
<td>16. Natalia Jaworska</td>
<td>Dr. Julie Kromm</td>
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<tr>
<td>17. Muhammad Saahim Salman, Critical Care SCN Studentship</td>
<td>Dr. Brent Winston</td>
</tr>
<tr>
<td>18. Mariam Ansari, MSc, Medical Sciences Program</td>
<td>Dr. Brent Winston</td>
</tr>
<tr>
<td>19. Inara Lalani, BSc Student, University of Calgary</td>
<td>Dr. Kirsten Fiest</td>
</tr>
<tr>
<td>20. Janelle Boram Lee, PhD Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
</tr>
<tr>
<td>21. Laurie Lee, PhD Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
</tr>
<tr>
<td>22. Amanda Leong, MSc in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
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<tr>
<td>23. Abigail Thomas, MSc in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
</tr>
<tr>
<td>24. Hina Qureshi, MSc in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
</tr>
<tr>
<td>25. Dr. Natalia Jaworska, MSc in Health Services Research</td>
<td>Dr. Kirsten Fiest</td>
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<tr>
<td>26. Em Schalm, MSc in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
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<tr>
<td>27. Stephana Moss, PhD Candidate in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
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<tr>
<td>28. Brianna Rosgen, MSc in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
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<tr>
<td>29. Samiha Mohsen, MSc in Epidemiology</td>
<td>Dr. Kirsten Fiest</td>
</tr>
<tr>
<td>30. Victoria Owen, MSc in Health Services Research</td>
<td>Dr. Kirsten Fiest</td>
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</table>

### 2021 Supervised Research Trainees (Continued...)

<table>
<thead>
<tr>
<th>Trainee Name</th>
<th>PI</th>
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</thead>
<tbody>
<tr>
<td>31. Stephana Moss, PhD., Dept. Community Health Sciences</td>
<td>Dr. Thomas Stelfox</td>
</tr>
<tr>
<td>32. Filip Lucini, Postdoctoral Fellow, Department of Critical Care Medicine</td>
<td>Dr. Thomas Stelfox</td>
</tr>
<tr>
<td>33. Camilo Valderrama Cuadros, Postdoctoral Fellow, Department of Critical</td>
<td>Dr. Thomas Stelfox</td>
</tr>
<tr>
<td>34. Anmol Shahid, Postdoctoral Fellow, Department of Critical Care Medicine</td>
<td>Dr. Thomas Stelfox</td>
</tr>
<tr>
<td>35. Derek Roberts, Assistant Professor, Department of Surgery, University</td>
<td>Dr. Thomas Stelfox</td>
</tr>
<tr>
<td>36. Abdel-Azz Shaheen, Assistant Professor, Department of Medicine and</td>
<td>Dr. Thomas Stelfox</td>
</tr>
<tr>
<td>37. Amanda Leong, MSc Student</td>
<td>Dr. Daniel Niven</td>
</tr>
<tr>
<td>38. Erin Gionet, MSc Student</td>
<td>Dr. Daniel Niven</td>
</tr>
<tr>
<td>39. Victoria (Tori) Owen, MSc Student</td>
<td>Dr. Daniel Niven</td>
</tr>
<tr>
<td>40. Dr. Andrew Bond, Internal Medicine Resident, Department of Medicine,</td>
<td>Dr. Daniel Niven</td>
</tr>
<tr>
<td>41. Dr. Josh Ng Kamstra, Critical Care Resident, Department of Critical</td>
<td>Dr. Daniel Niven</td>
</tr>
<tr>
<td>42. Dr. Simon Demers – Barriers to Prone Positioning</td>
<td>Dr. Ken Parhar</td>
</tr>
<tr>
<td>43. Dr. Lawrence Gutman – Critical Care Fellowship – Academic Advisor</td>
<td>Dr. Ken Parhar</td>
</tr>
<tr>
<td>44. Ms. Angelica Nguyen- Summer Student</td>
<td>Dr. Bryan Yipp</td>
</tr>
<tr>
<td>45. Ms. Elana Pyon- Summer Student</td>
<td>Dr. Bryan Yipp</td>
</tr>
<tr>
<td>46. Mr. Fletcher Liu</td>
<td>Dr. Bryan Yipp</td>
</tr>
<tr>
<td>47. Dr. Elise Granton. MD/PhD PhD</td>
<td>Dr. Bryan Yipp</td>
</tr>
<tr>
<td>48. Mr. Carlos Hiroki. PhD Immunology program</td>
<td>Dr. Bryan Yipp</td>
</tr>
<tr>
<td>49. Dr. Raquel Farias MD/PhD Eye’s High PDF awardee</td>
<td>Dr. Bryan Yipp</td>
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</table>
## Research at a Glance

<table>
<thead>
<tr>
<th>Category</th>
<th>Count</th>
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</thead>
<tbody>
<tr>
<td>Manuscripts</td>
<td>109</td>
</tr>
<tr>
<td>Abstracts</td>
<td>28</td>
</tr>
<tr>
<td>Grants</td>
<td>24</td>
</tr>
<tr>
<td>Trainees</td>
<td>49</td>
</tr>
<tr>
<td>Patents</td>
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</table>
### Department of Critical Care Medicine Research Grants

<table>
<thead>
<tr>
<th>Year</th>
<th>Sponsor</th>
<th>PO/CO Investigator</th>
<th>Title</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>2021-2022</td>
<td>CHIR</td>
<td>PI: Dr. Fiest &amp; Dr. Stelfox</td>
<td>Examining Drivers of Vaccine Hesitancy and Approaches to Improve Vaccine Confidence in Canada</td>
<td>$251,232</td>
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<tr>
<td>2021-2024</td>
<td>CHIR</td>
<td>PI: Dr. Fiest, Dr. Stelfox, COI: Dr. Zuege</td>
<td>ACCELERATE: Partnering with ICU patients and family caregivers toward early transitions in care</td>
<td>$355,725</td>
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<tr>
<td>2021-2023</td>
<td>CHIR</td>
<td>PI: Dr. Fiest</td>
<td>Restricted family presence in the PICU during the COVID-19 pandemic: Understanding impact, experience, and stakeholder priorities</td>
<td>$332,775</td>
</tr>
<tr>
<td>2021-2022</td>
<td>CHIR</td>
<td>PI: Dr. Stelfox</td>
<td>Engage, Educate, Empower: Partnering with Canadian Families to Understand and Mitigate the Multifaceted Impacts of the COVID-19 Pandemic on Child and Youth Wellbeing</td>
<td>$144,756</td>
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<tr>
<td>2021-2023</td>
<td>CHIR</td>
<td>PI: Dr. McDonald</td>
<td>Intravital imaging of COVID19 lungs to visualize pathogenic differences between SARS-CoV-2 variants of concern</td>
<td>$250,000</td>
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<tr>
<td>2021-2024</td>
<td>CHIR</td>
<td>PI: Dr. McDonald</td>
<td>National Preclinical Sepsis Platform: the role of biological sexon sepsis pathogenesis and outcomes</td>
<td>$544,318</td>
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<tr>
<td>2021-2026</td>
<td>CIHR</td>
<td>NPI: Dr. McDonald</td>
<td>Microbiota-immune interactions and host defense against infections and sepsis</td>
<td>$922,125</td>
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<tr>
<td>2021-2022</td>
<td>CHIR</td>
<td>PI: Dr. Winston</td>
<td>Using metabolomics for early detection and prognosis of patients with COVID-19 ARDS</td>
<td>$13,500</td>
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<td>2021-2021</td>
<td>CHIR</td>
<td>COI: Dr. Kromm</td>
<td>The Neurologic Physiology after Removal of Therapy (NeuPaRT) Study</td>
<td>$684,676</td>
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### Year Sponsor PO/CO Investigator Title Amount

- **2021-2024** CHIR COI: Dr. Fiest Adverse Drug Events and Medication Errors in adult Intensive Care Units $474,622
- **2021-2023** CHIR COI: Dr. Fiest New Frontiers in Research Fund: Breaking the Cycle of Intimate Partner Violence: Education, Identification, and Intervention $250,000
- **2021-2024** CHIR COI: Dr. Fiest, Dr. Parhar, Dr. McDonald Preparation to Trial in Inflammation for Chronic Conditions Team Grant: Therapeutic Targeting a Shared Inflammation Pathway in the Lung and Kidney $750,000
- **2021-2024** CHIR COI: Dr. Fiest, Dr. Stelfox Project Scheme: REVIVE: Frailty, Rehabilitation, and Hospitalization Outcomes in Adult and Pediatric Survivors of COVID-19 $738,224
- **2021-2023** Kidney Foundation of Canada COI: Dr. Stelfox Follow-up and Outcomes of Critically Ill Patients with Acute Kidney Injury $99,320
- **2021-2023** CHIR COI: Dr. Stelfox The right care, for the right patient, at the right time, by the right provider: A value-based comparison of the management of ambulatory respiratory diseases in walk-in clinics, primary care physician practices and emergency departments $879,751
- **2021-2023** CHIR COI: Dr. Stelfox Improving the quality of Canadian pediatric injury care: identifying priorities based on evidence, practice variations and stakeholder needs and preferences $608,176
- **2021-2022** CHIR COI: Dr. Stelfox Pulmonary vascular disease in patients with Long COVID $292,092
- **2021-2026** CIHR COI: Dr. Yipp A novel mouse model for human ‘STING-associated vasculopathy with onset in infancy’ (SAVI), a genetic auto-inflammatory disease $921,825
- **2021-2023** CHIR Project Grant COI: Dr. Parhar High-Flow Nasal Oxygen with or without Helmet Non-invasive Ventilation for Oxygenation Support in Acute Respiratory Failure (HONOuR) Pilot RCT $347,500
- **2021-2022** SSHRC (Insight Development Grant) COI: Dr. Zuege Critical care work during and after COVID-19: Exploring changing identities and Practices associated with recovery from burnout $62,990
- **2021-2024** Alberta Innovates - PRIHS COI: Dr. Zuege Dialyzing Wisely – Improving the delivery of acute renal replacement therapy to Albertans $830,225


Research Publications/ Presentations
Peer Reviewed Manuscripts (Continued...)


Abstracts


The Department of Critical Care Medicine gratefully acknowledges and thanks everyone for their contributions to this report.

Content Organization
Jo-El Buerlen

Document Design
Karen Olivos-Paredes