

Beth Israel Deaconess  
Medical Center



HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL

# Department of Anesthesia, Critical Care and Pain Medicine

2020–2021 Biennial Report





# Welcome



**Daniel S. Talmor, MD, MPH**  
 Chair, Department of Anesthesia,  
 Critical Care and Pain Medicine  
 Edward Lowenstein  
 Professor of Anaesthesia

Welcome to the Department of Anesthesia, Critical Care and Pain Medicine! This report documents some of the many impressive accomplishments in the department over the past two years. These accomplishments underscore the remarkable work of our team in a particularly difficult time. Together, we provide skilled and compassionate clinical care, inspiring education and innovative research. Our department members led the management and continuous improvement of high-quality, effective patient-centered care. As chair and a longtime member of the department, I offer my personal appreciation and admiration for the expertise, collegiality and dedication of our impressive team of physicians, nurses and support staff.

Since our last report two years ago, we have expanded our department to cover much of the Beth Israel Lahey Health (BILH) network. In addition to our work at the academic Beth Israel Deaconess Medical Center (BIDMC), we now provide services at BID-Milton; BID-Needham; BID-Plymouth; Mount Auburn Hospital; New England Baptist Hospital and its associated ambulatory facility in Dedham; Anna Jaques Hospital; and the three hospitals of Cambridge Health Alliance. This unprecedented expansion brought dozens of new providers into our family, and while it was not simple or easy, I am happy to say that we have improved access and care across all of these hospitals while providing a stable home for our department members. In all of this work, the department has led the way for the integration of hospital-based clinical services throughout the BILH network.

Our department has significant strengths. First and foremost, our faculty is clinically excellent. We provide cutting-edge clinical care supporting the most complex surgical services. We are among the hardest-working physicians in the network. We take huge pride in our individual achievements, our work as a department and the medical centers at which we work. This intense loyalty and dedication among our staff produces results. The clinical outcomes of our cases are second to none across all three areas of service: operative anesthesia, critical care medicine and pain medicine.

This hard work and dedication paid off over the last 18 months of the COVID-19 pandemic. Albert Camus wrote in his book, *The Plague*: “What’s true of all the evils in the world is true of plague as well. It helps men to rise above themselves.” During the pandemic, our physicians, certified registered nurse anesthetists, nurses and technicians spread out across all of our hospitals to take care of hundreds of patients in the operating rooms and intensive care units (ICUs) each day.

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**Alan Lisbon, MD**  
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 Anesthesia, Critical Care and  
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 Harvard Medical School

### Editor’s Note

This biennial report of the Department of Anesthesia, Critical Care and Pain Medicine highlights the extraordinary work and achievements of our department members for the academic years 2020-2021. These past two years have been unprecedented in the challenges we faced as clinicians and individuals. Despite these obstacles, our department has grown academically and as a united community dedicated to a vision of excellent clinical care, groundbreaking research and innovative medical education. I hope you find the report interesting and informative. —Alan

### Editorial & Production

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Sections were written by their respective Division Directors.



(continued from p. 3)

At BIDMC, our department staffed nine ICU teams, including the complex respiratory unit where the sickest patients were cohorted for assessment and treatment with extracorporeal membrane oxygenation.

Our department has come out of the pandemic stronger than we were when we went into it. We are now working hard on a reset of our strategic plan, which will help guide us through the next five years. We hope the years ahead will be equally rewarding—but slightly less exciting—than the last five have been. We are stronger than ever now, and whatever challenges we face, we will meet them with the same resilience and excellence we always have.

—Danny



### Mission

- **Improve** the quality of our patients' lives by providing compassionate, equitable, state-of-the-art care.
- **Advance** the field of medicine by generating new knowledge and educating future leaders in anesthesia, critical care and pain medicine.
- **Value** our people by intentionally supporting their unique personal and professional development goals.
- **Strive** for a diverse department that serves vulnerable populations.
- **Promote** improvement, innovation, and integration across the system of care.

### Vision

- **Patients First** We take ownership and responsibility for ensuring a superb patient experience, including high-quality, safe, and equitable care.
- **Trust and Respect** We embrace diversity and inclusion among the entire care team, and respect for all those who trust in our care.
- **Innovation** We constantly seek opportunities to create new value through breakthrough ideas and performance.
- **Excellence** We strive for excellence in all that we do.

Our community embraces these values, and we ask that all our members model this behavior, every day, every time.



### Code of Conduct

W	E	L	C	O	M	E
<b>Workplace</b>	<b>Equity</b>	<b>Listening</b>	<b>Communication</b>	<b>Opportunities</b>	<b>Mindful</b>	<b>Educate</b>
Create a collegial and safe workplace	Equitable and fair treatment for all	Listen respectfully	Communicate frequently in a transparent, courteous and caring manner	Create and pursue opportunities for growth and development	Be mindful, observe yourself and treat others the way they want to be treated	Empower others and model welcoming behavior

## Our Community Hospitals

We provide anesthesia, critical care and pain medicine services and oversee day-to-day operations of the ORs at nine locations including our BIDMC Boston main campus, BID-Milton, BID-Needham, BID-Plymouth, Anna Jaques Hospital in Newburyport, Mount Auburn Hospital in Cambridge, New England Baptist Hospital in Boston and New England Baptist Outpatient Care Center in Dedham. We also provide anesthesia services to our BILH affiliates: Cambridge Health Alliance which includes Cambridge Hospital, Everett Hospital, and Somerville Hospital; and Boston IVF.





Department of Anesthesia, Critical Care and Pain Medicine

2021



# Harvard Faculty



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# BIDMC Clinical Anesthesia



**J. Michael Haering, MD**  
 Vice Chair, Clinical Affairs  
 Director, Clinical Operations-West Campus  
 Assistant Professor of Anaesthesia

## Introduction

The Clinical Anesthesia Program provides anesthesia services for all operating rooms, the labor and delivery suite, and non-operating room procedural areas at Beth Israel Deaconess Medical Center (BIDMC).

At BIDMC, we staff 40 operating rooms (ORs) between Boston's East and West campuses, located in three main suites (19 on Main-West, 11 in Feldberg-East, and 10 in the Shapiro Ambulatory Suite-East). Non-OR procedural areas include three sets of gastrointestinal (GI) endoscopy suites, three electro-physiology (EP) suites, two angiography suites, an endovascular procedure suite, and CT, MRI and ECT suites. Clinical anesthesia divisions include cardiac, vascular, thoracic, orthopedic, neurosurgical, transplant, ambulatory, regional, GI, office based, pre-admission testing, and obstetrics.

Our resilience was tested this year with the COVID-19 pandemic. We were forced to cancel all elective surgery and redeployed our attending staff, CRNAs, NPs, residents and fellows to care for patients with COVID. Not only did many of us change our locations, we changed our roles, with redeployments in surge ICUs at BIDMC, in our community hospitals and to regional sites as well. Residents and fellows worked as intensivists. CRNAs not only took on the role of bedside caregivers as members of our many ICU teams, but also filled in as respiratory therapists. After two witheringly stressful and challenging waves, we return to a more normal state in spring 2021, having reopened all of our operating rooms.

Work on the new medical tower on the West Campus continued throughout the pandemic. It will be connected to our current OR space, doubling the square footage of our OR footprint on the West campus. There will be seven new large ORs, four catheterization labs and an additional hybrid OR to add to the current three we have now, as well as plenty of support space. We anticipate this new space will be open in 2023. The buildout of One Brookline Place has also started. This four-room outpatient surgery center is scheduled to open in 2022, serving patients undergoing gynecologic, ophthalmologic, orthopedic and gastroenterologic procedures.

Governance of perioperative services at BIDMC is handled by the Operating Room Executive Committee (OREC), a subcommittee of the Medical Executive Committee. OREC is responsible for strategic planning for the operating rooms and meets biweekly. This committee is chaired by Vice-President of Perioperative Services Dr. Ruben Azocar (a member of our department), with representation by several members of the Anesthesia Department.



**Eswar Sundar, MBBS**  
 Director, Clinical Operations-East Campus  
 Assistant Professor of Anaesthesia

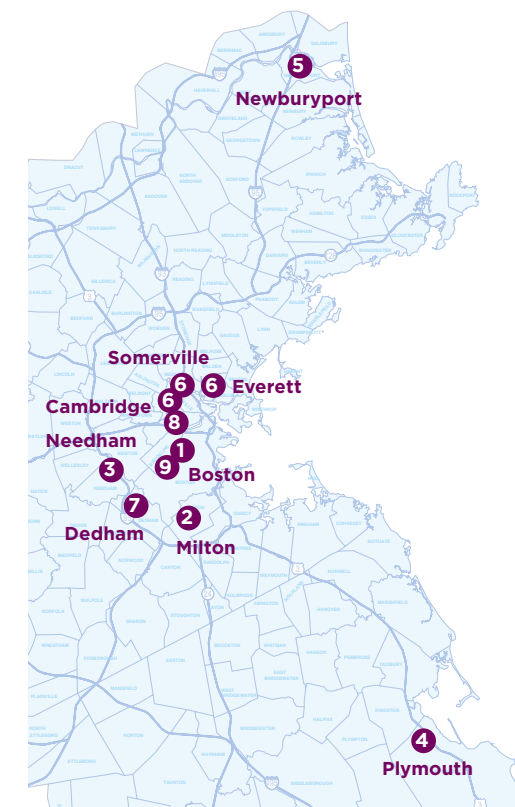
Our presence in the community has continued to increase dramatically. With the incorporation of the former Anesthesia Associates of Massachusetts sites in 2019, we have become one of the largest academic departments in the country. These new members of our anesthesia family include Mount Auburn Hospital, New England Baptist Hospital and its Dedham surgery center, three Cambridge Health Alliance (CHA) hospitals and Boston IVF. Our relationship with CHA bears special note, as it represents our ongoing ambition to provide care to our most vulnerable populations by supporting the institutions that serve these communities. Equally important is our ongoing coverage at BID-Plymouth and Anna Jaques Hospital in Newburyport, and our long-standing coverage at BID-Needham and BID-Milton. Anna Jaques Hospital and BID-Plymouth both require in-house coverage for OB anesthesia and both provide pediatric care. We also cover the ICU and Pain Clinic at BID-Plymouth and critical care at BID-Milton. OR integration happens in concert with senior hospital leadership to make the best use of our OR resources—namely, driving lower-acuity care out to the community. We have helped create effective OR governance in the community and connected these hospital ORs to the main campuses with a robust IT system, after creating common definitions and accountability for OR metrics and efficiencies.

Much of the clinical planning and decision-making is handled by a newly invigorated Clinical Affairs Committee (CAC). Since its inception in August of 2020, the committee has addressed, managed or adjudicated numerous clinical topics as far-ranging as high-flow nasal oxygen and the perioperative management of cardiac and non-cardiac implantable devices. In addition, it has reviewed and developed policies, updated and created clinical pathways and managed our annual capital request process.

The Anesthesia Department continues to expand to support additional space and growing volume at our Boston Campus and our community hospitals. With the addition of many new staff to our department, we have a total of 159 attendings, 104 certified registered nurse anesthetists, 21 NPs, 20 anesthesia technicians, three clinical engineers, 10 information technology specialists, house staff consisting of 54 residents, 12 interns, and 21 fellows, 111 administrative staff and 70 research staff.

This is an exciting time for the Clinical Anesthesia Program as we look to increase our volume and locations across the network. As we expand, we are laying the foundation for structural integration and support systems for all members of our department, with the ultimate goal of improving patient care.

## Network Map



- 1 Beth Israel Deaconess Medical Center
- 2 Beth Israel Deaconess Hospital -Milton
- 3 Beth Israel Deaconess Hospital -Needham
- 4 Beth Israel Deaconess Hospital -Plymouth
- 5 Anna Jaques Hospital
- 6 Cambridge Health Alliance -Cambridge Hospital -Everett Hospital -Somerville Hospital
- 7 Dedham Surgery Center
- 8 Mount Auburn Hospital
- 8 Boston IVF
- 9 New England Baptist Hospital





# Our Stats

582 Department Members



1 Academic Medical Center

10 Community Hospitals

96,470 Cases FY2019

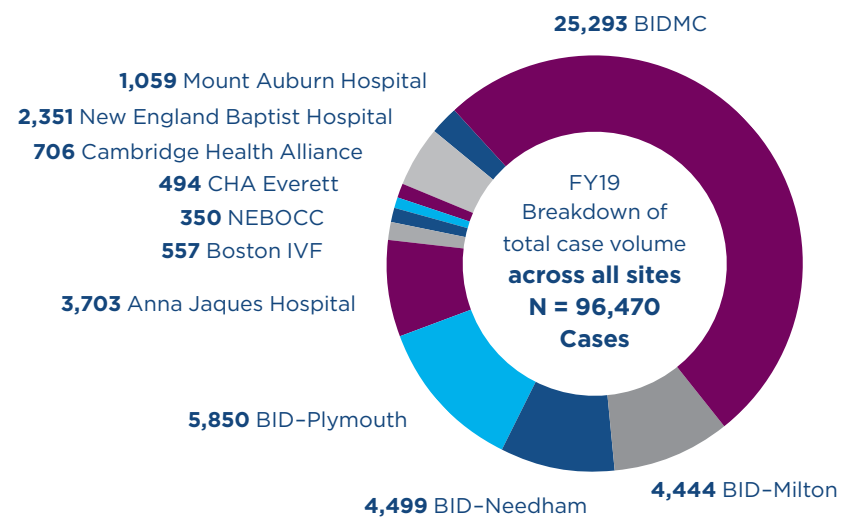
87 ORs across the network

## Anesthetizing locations across the network

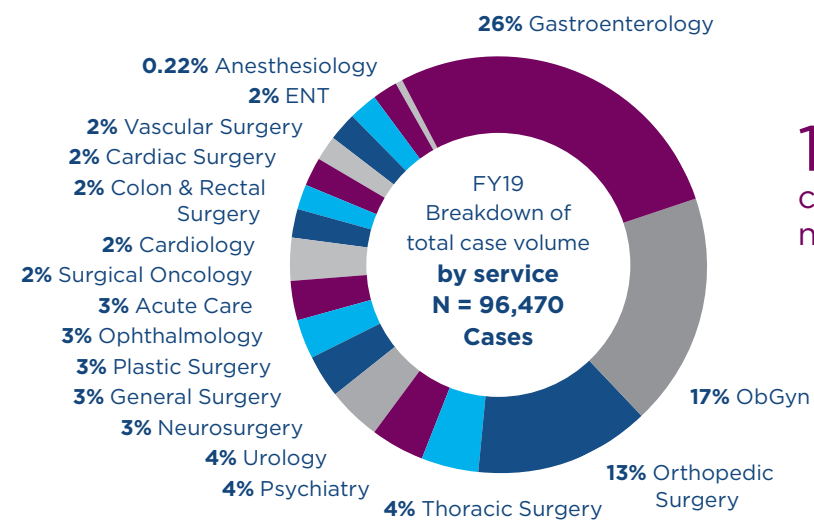


Hospital	Number of Locations
Anna Jaques Hospital	9
BIDMC	62
BID-Milton	12
BID-Needham	6
BID-Plymouth	14
Boston IVF	2
Cambridge Health Alliance	9
Mount Auburn Hospital	16
New England Baptist Hospital	16
NEBOCC	8
<b>Total (Projected for FY21)</b>	<b>154</b>

## Total case volume across the network in FY19



## Case breakdown by service

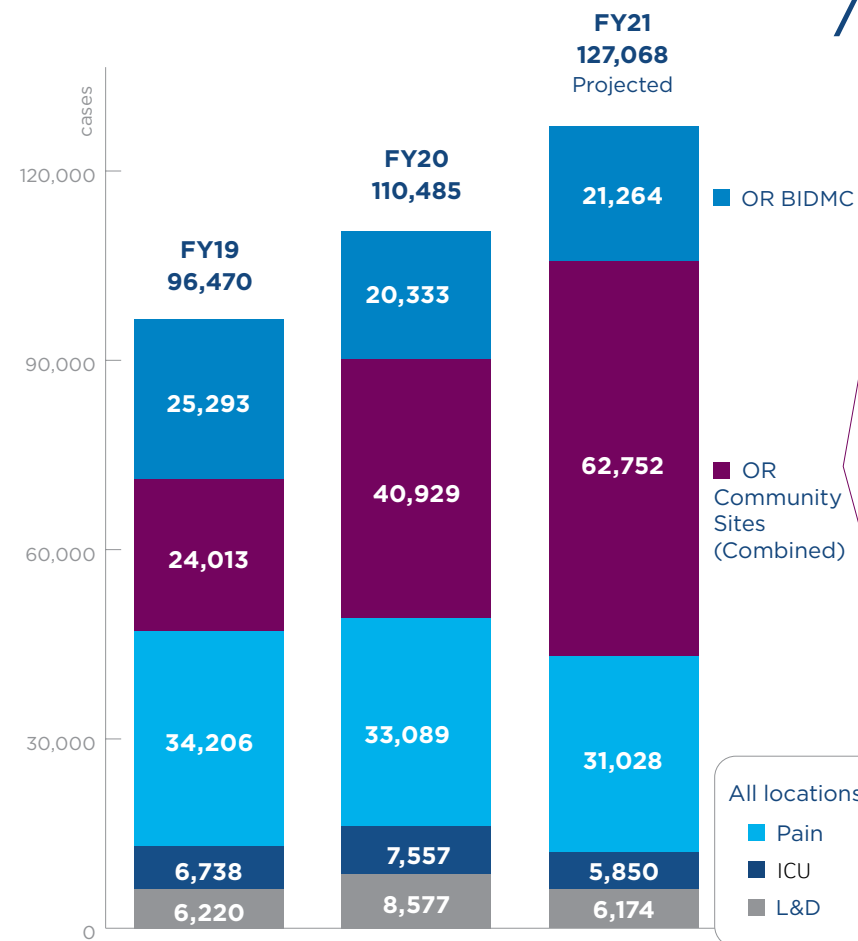


## Staff roster

- 159 attendings
- 104 certified registered nurse anesthetists
- 21 NPs
- 20 anesthesia technicians
- 3 clinical engineers
- 10 IT specialists
- 54 residents
- 21 fellows
- 12 interns
- 111 administrative staff
- 70 research staff



## Total case volume across sites



OR Community Sites	FY19 (cases)	FY20 (cases)	FY21* (cases)
Milton	4,444	4,045	5,620
Needham	4,499	3,607	4,630
Plymouth	5,850	5,774	9,264
Anna Jaques	3,703	2,903	4,999
Mount Auburn	1,059	5,554	6,859
NEBH	2,351	9,726	20,761
CHA Cambridge	557	2,579	3,578
CHA Everett	350	1,566	1,845
NEBOCC	494	1,526	1,560
Boston IVF	706	3,649	3,636

- \*FY21 Projected is based on actual October 2020 through March 2021 annualized.
- OR data does not include L&D, Inpatient or Post-Op Pain
- Pain does not include Inpatient Pain or Post-Op Pain



# Associated Physicians of Harvard Medical Faculty Physicians

## Vice Chair

**Ross Musumeci, MD**  
Vice Chair, Network Anesthesia

## CMO

**Aileen Starnbach, MD**  
CMO, Network Anesthesia  
Site Chief, MAH

## Site Chiefs

**Chad Anderson, MD**  
Site Chief, Anna Jaques

**Erin Burns, MD**  
Site Chief, BID-Plymouth

**Victoria Derevianko, MD**  
Site Chief, BID-Milton

**Pei-Lin Kim, MD**  
Site Chief, Boston IVF

**J. Joseph Mackey, MD**  
Site Chief, CHA

**Michael Young, MD**  
Site Chief, NEBH, NEBOCC

## Associate Site Chiefs

**Andrew Koropecy, MD**  
Associate Site Chief,  
BID-Milton

**Samir Patel, MD**  
Associate Site Chief, NEBH  
Director ICU, BID-Milton

**Mohammed Hassan, MD**  
Associate Site Chief, NEBOCC

**John Wadlington, MD**  
Associate Site Chief, Everett

**Annie Woon, MD**  
Associate Site Chief, CHA

**Rowland Wu, MD**  
Associate Site Chief, MAH

**Matthew Bloch, MD**

**Katherine Bourne, MD**

**Vladimir Eisenberg, MD**

**Jason Erlich, MD**

**Jennifer Evansmith, MD**

**Lawrence Gibbons, MD**

**Zachary Glicksman, MD**  
Director of Cardiac, MAH

**Donna Griffith, MD**

**Frank Gu, MD**

**Jessica Heath, MD**

**Sharon Herman-Berreby, MD**

**Mihaela Ionita, MD**

**Hemant Joshi, MD**

**Ben Kaon, MD**

**Sonia Kapoor, MD**

**Mark Kats, MD**

**Vladimir Kazakin, MD**

**Phil Krapchev, MD**

**Anna Margulian, MD**

**Jan Matejka, MD**

**Benjamin Moor, MD**

**Elizabeth Moore, MD**  
Director of OB Anesthesia,  
APHMFP

**Katherine Nixon, MD**

**Neil Oliwa, MD**

**James O'Rourke, MD**

**Steven Parker, MD**

**Robert Giu, MD**

**Aimee Reilly, MD**

**Elaman Vijayakumar, MD**

**Christopher Walters, MD**

**Jianxun (Jason) Wang, MD**

**Mark Wechsler, MD**

**Christopher Wenger, MD**

**Jessica White, MD**

**Lisa Wollman, MD**

**Albert Woo, MD**

**Natalia Yaromenka, MD**

**Svetla Kurteva Yordanov, MD**

**Sana Zaidi, MD**

**Dana Zalkind, MD**

**Dezhen Zhang, MD**

**Patricia O'Connor, CRNA**  
System Chief CRNA

**Claudia Ambrus, CRNA**

**Matthew Ascione, CRNA**

**Randy Barnhard, CRNA**

**Kristen Bellmonte, CRNA**

**Hillary Bloom, CRNA**

**Amy Bogosian, CRNA**

**Joan Botelho, CRNA**

**Traci Brown, CRNA**

**Richard Burns, CRNA**

Site Manager, NEBH

**Shelby Butler, CRNA**

**Katherine Canina, CRNA**

**Katelyn Caron, CRNA**

**Dayna Cary, CRNA**

**Joseph Casassa, CRNA**

**Lori Cetrino, CRNA**

**John Cona, CRNA**

**Shannon Conley, CRNA**

**Beth Coolidge, CRNA**

**Jessica Coxson Bunnell, CRNA**

**Alena Curry, CRNA**

**Matthew Daube, CRNA**

**Elizabeth Demartini, CRNA**

**Kathleen Demian, CRNA**

**Kevin Doherty, CRNA**

**Nancy Dunn, CRNA**

**Susan Emery, CRNA**  
Site Director, BC Program

**Brian Fenn, CRNA**

**Nicholas Ferrari, CRNA**  
Site Manager, NEBH

**Stacey Galvin, CRNA**

**Penne Greer, CRNA**

**Shannon Griffin, CRNA**  
Scheduler, MAH

**Richard Guillaume, CRNA**

**Erin Herrmann, CRNA**

**James Howard, CRNA**

**Beth Hughes, CRNA**

**David Kelleher, CRNA**  
Site Manager, Anna Jaques

**Elizabeth Kittredge, CRNA**

**Dorothy Kushmerek, CRNA**

**Ann Larson, CRNA**

**Christine Maggs, CRNA**  
Site Manager, MAH

**Hope Mangili, CRNA**

**Febrianty Manna, CRNA**  
Site Manager, MAH

**Daniel Marriggi, CRNA**  
Site Manager, BID-Milton

**Robert Martin, CRNA**

**Marissa Mattei, CRNA**

**Khyela Matthews, CRNA**

**Lauren McGrath, CRNA**

**Jah McLernan, CRNA**

**Karl Mitchell, CRNA**

**Martina O'Connel, CRNA**

**Kaylen Parent, CRNA**

**Anthony Procopio, CRNA**

**Valerie Razis, CRNA**

**Catherine Rielly, CRNA**

Site Manager, CHA

**Susan Roessle, CRNA**

**Kirsten Ross, CRNA**

**Megan Ruane Rice, CRNA**

**Sachiko Sato, CRNA**

**Doris Schneller Sheils, CRNA**

**Allan Thomas, CRNA**

**Amy Townsend, CRNA**

**Peter Tsinzo, CRNA**

**Victoria Turaman, CRNA**

**Eduardo Vargas, CRNA**  
Site Manager, BID-Plymouth

**Maria Clara Vaz, CRNA**

**Caitlin Vitale, CRNA**

**Priscilla Watson, CRNA**

**Nancy Waywood, CRNA**  
Site Manager, CHA





# Community Hospitals



**Riki Kveraga, MD**  
Site Chief, BID-Needham  
Vice Chair, Network South  
Assistant Professor of Anaesthesia



**Ross Musumeci, MD, MBA, FASA**  
Vice Chair, Network Anesthesia

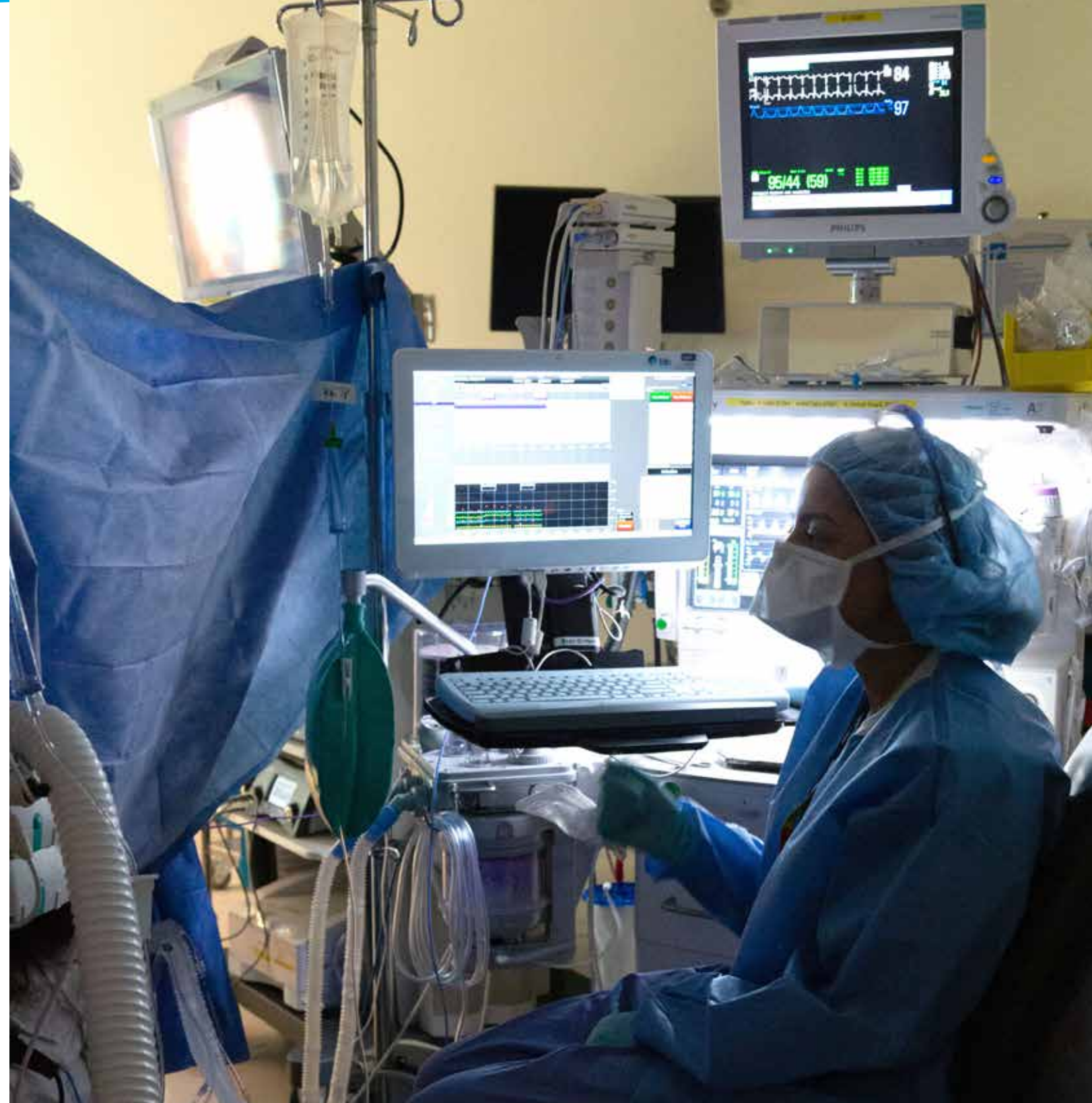
## Introduction



Our department has doubled in size over the past two years and significantly expanded into the community. We completed a successful integration with the former Anesthesia Associates of Massachusetts that brought many highly experienced clinicians to our team. This infusion of new staff has allowed us to add clinical coverage to seven new community locations, including New England Baptist Hospital, New England Baptist Outpatient Care Center, Mount Auburn Hospital, Cambridge Hospital, Everett Hospital, Somerville Hospital and the Boston IVF fertility center. Our community network now includes 11 hospital and outpatient locations, and we continue to evaluate opportunities for further growth.

Coordination between our large academic center, Beth Israel Deaconess Medical Center, and its affiliated community sites provides clear benefits to all involved — a sophisticated quality-improvement program, professional leadership, financial stability and diversity of professional expertise and experience. These advantages are the result of resource-sharing between lower-acuity community hospitals and the higher-acuity, academically focused main campus. The combined strength and superior teamwork resulting from this integration was on full display during the COVID-19 pandemic during this past year. All of our sites performed superbly. The sharing of information, best practices and staff allowed us to successfully care for the large influx of patients and provide full clinical coverage wherever and whenever it was needed.

Our goals for the upcoming year are to continue the integration of community and academic services in order to maximize the gains from this union. Our reputation for excellent service continues to bring new opportunities our way, so it is likely that our growth will continue as we move forward. As always, our focus remains on our commitment to provide our patients with the highest-quality care and to do so in the most efficient manner possible.





# Beth Israel Deaconess Hospital–Milton



**Victoria Derevianko, MD**  
Site Chief, BID-Milton  
Instructor in Anaesthesia

“At Milton, it’s all about family. We care for our patients like family, and we care for each other like family.”

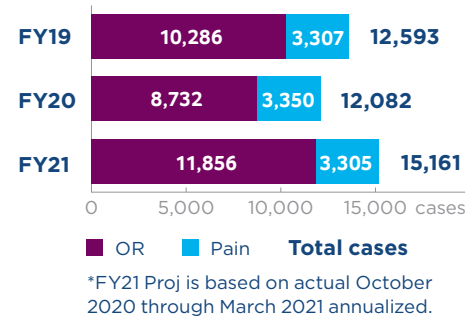
Beth Israel Deaconess Hospital–Milton (BID–Milton) is a 100-bed community hospital with 24-hour emergency and surgical services, eight operating rooms, four endoscopy suites, and an eight-bed intensive care unit (ICU). The BID–Milton Department of Anesthesia combines staff from both Harvard Medical Faculty Physicians and the Associated Physicians of Harvard Medical Faculty Physicians to provide high-quality, patient-centered care throughout the hospital. Our current staff includes 10 anesthesiologists who rotate in the operating rooms and endoscopy suites, seven intensivists who provide ICU coverage, two pain medicine specialists, 15 Milton-based nurse anesthetists, and dedicated nurse practitioners for the Pain Clinic and the Pre-Admission Testing (PAT) Clinic.

## Clinical

Outside of the COVID-19 surges, when elective surgeries were curtailed, our care teams saw record numbers in the operating rooms and endoscopy suites over the past year. There was a 25% increase in orthopedic surgeries performed as compared to fiscal year 2018, in spite of pandemic conditions. With regard to total joint replacements, this includes both revisions as well as more complex procedures. Our department purchased a new state-of-the-art ultrasound and has expanded our regional anesthesia program to include nerve blocks for both total knee replacements as well as ambulatory hand and foot surgeries. Our goal has been to improve the patient experience, decrease recovery time and decrease the length of hospital admission. We also purchased a device for point-of-care hemoglobin testing in the operating room, which allows us to improve perioperative care for our increasing number of medically complex patients, especially our elderly population with hip fractures. We are in the process of developing a protocol for same-day-discharge total joint replacements and look forward to offering this in the coming months.

In addition to orthopedic procedures, we have seen a large increase in robotic and minimally invasive cases in all specialties. We developed and implemented enhanced recovery after surgery, or ERAS, protocols for most of these departments. The Anesthesia Department is represented by both anesthesiologists and nurse anesthetists on almost all perioperative meetings for the hospital, including the surgical steering committee, the robotic steering committee and the orthopedic steering committee.

**BID–Milton Case Volume FY19–FY21**



## Faculty

- Andrew J. Koropey, MD  
Associate Site Chief, BID–Milton  
Instructor in Anaesthesia
- Vimal K. Akhouri, MD, MBBS  
Assistant Professor of Anaesthesia
- Sheila R. Barnett, MBBS, BSc  
Chief Medical Officer, BID–Milton  
Associate Professor of Anaesthesia
- Sharon Herman-Berreby, MD
- Jeffrey K. Jankun, MD  
Assistant Professor of Anaesthesia
- Lior A. Levy, MD  
Instructor in Anaesthesia
- Haobo Ma, MD, MS  
Instructor in Anaesthesia
- Anna Margulian, MD
- Andrey Rakalin, MD  
Instructor in Anaesthesia
- Scott D. Zimmer, MD  
Instructor in Anaesthesia

## ICU Faculty

- Samir Patel, MD  
Director ICU, BID–Milton
- Rae M. Allain, MD  
Member of the Faculty
- Somnath Bose, MD, MBBS  
Assistant Professor of Anaesthesia
- Jessica Cassavaugh, MD, PhD  
Instructor in Anaesthesia
- Megan L. Krajewski, MD  
Instructor in Anaesthesia
- Sara E. Neves, MD  
Instructor in Anaesthesia
- Ameeka Pannu, MD  
Instructor in Anaesthesia

## Pain Faculty

- Paragi H. Rana, MD  
Instructor in Anaesthesia
- Cyrus A. Yazdi, MD  
Instructor in Anaesthesia

## Nurse Practitioner

- Lindsay Gusiora, NP

## CRNAs

- Dan Marriggi, CRNA  
Site Manager
- Claudia Ambrus, CRNA
- Kelley Balestracci, CRNA
- Joan Botelho, CRNA
- Traci Brown, CRNA
- Katherine Canina, CRNA
- Lori Cetrino, CRNA
- Elizabeth Demartini, CRNA
- Stacey Galvin, CRNA
- Erin Herrmann, CRNA
- Hope Mangili, CRNA
- Marybethe Sabeti, CRNA
- Sachiko Sato, CRNA
- Elizabeth Stansberry, CRNA

## OR Support Tech

- Ramiro Mejia-Helpps

## COVID-19

When the state mandated closure of operating rooms in March 2020, we focused our energy on supporting the hospital’s COVID efforts. With the help of our Boston colleagues, we developed protocols for safely transporting and caring for COVID patients in the operating room. We established new simulation training exercises to ensure staff could execute all of these operations safely and seamlessly. During the height of the pandemic, our staff remained in-house at all times to assist with airway management for COVID patients throughout the hospital. “Airway teams” were established and were a vital hospital resource during this time. We secured eight new power air-purifying respirators for the department and have maintained and utilized them in the ICU, the emergency department, and the operating rooms.

As we began to return to normal operations, we continued to support the case-load in the operating room and our endoscopy suites. In fact, between July and November 2020, our operating rooms saw a 10% increase in case volume as compared to the same time period in 2019. Furthermore, we have provided oversight in the Post-Anesthesia Care Unit as “team leaders” due to nursing staff shortages throughout the hospital. The highlight of our year, however, has been supporting the COVID vaccination clinic at BID–Milton. We were ecstatic to be involved in such a pivotal moment in history and to see the smiles and happy tears as the hospital staff received the vaccine.

Behind the scenes, our PAT Clinic has continued to support our cases in the operating room, seamlessly transitioning to virtual appointments, either via telephone or a video interface based on patient preference.

The ICU, under the leadership of Dr. Samir Patel, has played an integral role during the pandemic with the support of our anesthesiologists. As was expected, volume increased significantly during the pandemic, and, in April 2020, we opened a surge-ICU to accommodate the increased COVID-positive patient load. The surge unit is located in the Post-Anesthesia Care Unit space, and the anesthesia staff was critical in the opening of this space. We assisted with transport of patients and with setting up anesthesia machines to be used as ventilators. We also assisted in the ICU with prone positioning of critically ill, ventilator-dependent patients.

The Pain Clinic continues to see a substantial number of patients, despite adapting to telehealth during the pandemic. In fact, in September 2020, there was a 120% increase in outpatient visits as well as a 17% increase in outpatient procedures (as compared to September 2019). This is extraordinary considering the extra precautions in place due to COVID. The team is currently handling basic interventional pain procedures in-house and is hoping to expand to more complex procedures in the operating room this year, including spinal cord stimulators and kyphoplasty.

## Conclusion

While the past year has presented our department with many unexpected obstacles, we rose to the challenge with enthusiasm and ingenuity. We look forward to continuing to improve and expand upon our existing services.





# Beth Israel Deaconess Hospital–Needham



**Riki Kveraga, MD**  
Site Chief, BID–Needham  
Assistant Professor of Anaesthesia

“We are the smallest BILH community hospital, but great things are happening here! Everyone feels like part of a family, and we take the very best care of our patients—who often tell us they’re treated like family and not just a number.”



## Clinical

Beth Israel Deaconess Hospital–Needham (BID–Needham) is a 58-bed community satellite hospital in the Beth Israel Lahey Health (BILH) network. The surgical pavilion has a state-of-the-art “open concept” pre-anesthesia holding area, a Post-Anesthesia Care Unit (PACU), and six operating rooms (ORs) with two new operating suites to accommodate growing surgical volume. One OR suite is a dedicated cystoscopy room, and two are laparoscopic suites. During 2021, BID–Needham will expand its smallest OR to accommodate all but the most equipment-intensive surgeries.

Our ORs handled 3,736 cases in 2020. The year began very strong, and we were on target to have the greatest volume historically, but the COVID-19 pandemic hit and brought the ORs to a standstill. It took us until July to recover surgical volume. With the second surge at the end of 2020 and beginning of 2021, we attempted to keep the ORs utilized at a higher rate compared to the first surge, but were limited by OR staff redeployments and our loss of PACU space for use as surge space for ICU patients. After the second surge passed, we reopened the ORs, and OR volume recovered quickly.

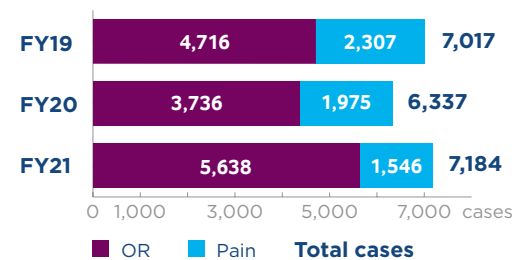
BID–Needham services provide:

- Minimal-access laparoscopic surgery, including colorectal surgery
- Plastics and reconstructive procedures
- Orthopedic sports medicine
- Total and complex joint replacements
- Hand, ankle and podiatry sports medicine
- Adult otolaryngology
- Cancer surgery
- Urological procedures for men and women
- Women’s health and gynecologic procedures
- Men’s health surgeries
- Limited pediatric otolaryngology medicine

In 2021, BID–Needham will also be adding simple neurosurgical services.

BID–Needham uses a pre-admission system that reaches out to prepare all patients for elective surgery. They gather in-depth medical histories, provide patient education, and set patient expectations. This system leads to very low day-of-surgery cancellation rates.

**BID–Needham Case Volume FY19–FY21**



\*FY21 Proj is based on actual October 2020 through March 2021 annualized.

## Faculty

- Vimal K. Akhouri, MD  
Assistant Professor of Anaesthesia
- Amanda K. Anastasi, MD  
Assistant Professor of Anaesthesia
- Lauren K. Buhl, MD, PhD  
Instructor in Anaesthesia
- Hyun Kee Chung, MD  
Instructor in Anaesthesia
- Lisa J. Kunze, MD, PhD  
Assistant Professor of Anaesthesia
- Mahmoud Labib, MD  
Instructor in Anaesthesia
- Soumya Mahapatra, MD  
Instructor in Anaesthesia
- M. Leo Tsay, MD  
Instructor in Anaesthesia
- Joan E. Spiegel, MD  
Assistant Professor of Anaesthesia

## ICU Faculty

- Somnath Bose, MD, MBBS  
Director ICU, BID–Needham  
Assistant Professor of Anaesthesia

## CRNAs

- Elizabeth Cardone, CRNA
- Christine Dundon, CRNA
- Donna Greene, CRNA
- Sarah Hayden, CRNA
- Elizabeth Heckman, CRNA
- James Hogan, CRNA
- Eileen Lyons, CRNA
- Kayleigh McDonald, CRNA
- Patricia O’Connor, CRNA
- Rebecca Pevye, CRNA
- Jennifer Phelan, CRNA
- Naira Qazi, CRNA
- William Rice, CRNA

## Nurse Practitioner

- Katrina Robertson, NP

## Anesthesia Tech

- Adam Carlson

## Administrative Coordinator

- Yvette Dusabe



We have implemented a variety of subspecialty-specific multimodal analgesia pathways for several types of services. These include a number of innovative peripheral nerve blocks that enhance the entire post-surgery recovery. For total joint-replacement surgery, we have impressive continuity in care with regard to pain management. With hospital support, we developed a program in which a nurse practitioner specializing in pain sees joint-replacement patients preoperatively in pre-admission testing and prepares them for their experience, particularly with regard to postoperative pain. On the day of surgery, they are seen again in pre-op and then followed up every day until they are discharged. This continuous interaction helps the department achieve consistently higher-than-average scores on pain management in a very challenging patient population.

During 2020 and 2021, a multi-disciplinary team has been working on creating an outpatient joint pathway to streamline appropriate patients to have their joint-replacement surgery and go home the same day.

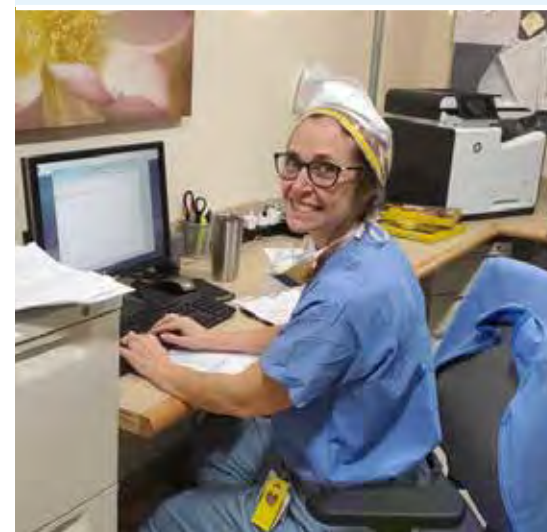
All our efforts in the area of patient satisfaction with ambulatory surgery have paid off — greater than 95% of patients coming to BID–Needham would be very likely to recommend having surgery here.

## Education

The high volume of orthopedics at BID–Needham offers an excellent opportunity to develop a rotating Regional Anesthesia Fellowship in combination with BIDMC. Currently there is a practice-management rotation for BIDMC residents nearing graduation at BID–Needham. They gain experience supervising and working with certified registered nurse anesthetists, managing a fast-paced OR, and learning more about the intricacies of running an efficient OR similar to that found in private practice.

## Quality Improvement

In 2020, the BIDMC Quality and Safety team, with CRICO support, brought Root Cause Analysis team training to the community. We were the first community hospital in the system to invite this extremely important quality program to present to our teams. The program was successful and well-received by clinicians, who were very engaged with this approach. In 2021, the BIDMC Quality and Safety team will implement in situ simulations through the CONCISE study to help improve responses to emergency situations in remote locations. Lastly, the much-anticipated BILH Anesthesia Emergency Manual, designed specifically for BID–Needham, will be implemented in all anesthetizing locations at the hospital.





# Beth Israel Deaconess Hospital–Plymouth



**Erin Burns, MD**  
Site Chief, BID–Plymouth

“BID–Plymouth is a busy and expanding community hospital in the BILH network. We provide exceptional care to the patients of southeastern Massachusetts. Patient safety and satisfaction are our greatest priorities, and our committed team strives to provide all patients with a high-quality and personal experience when receiving care in our hospital.”

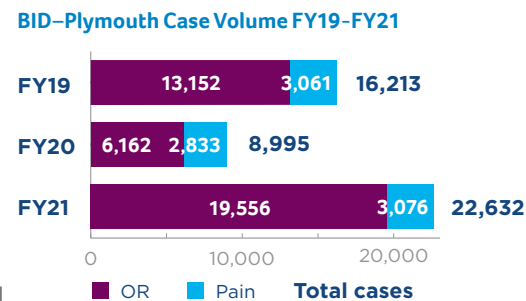
## Clinical

Beth Israel Deaconess Hospital–Plymouth (BID–Plymouth) is a 160-bed community hospital in the Beth Israel Lahey Health network. We are the southernmost site of the network and serve many patients who live on Cape Cod. Our surgical suite consists of eight state-of-the-art operating rooms (ORs) and a pre-op area that is contiguous with a spacious Post-Anesthesia Care Unit (PACU). Our operating rooms are equipped with laparoscopic equipment, and we offer Brainlab image-guided surgery for complex spine surgery.

At BID–Plymouth, OR volume for fiscal year 2020 was 6,162; this 11% decrease was caused by the cancellation of elective surgery from March 17 to June 8, 2020, due to the COVID-19 pandemic. During the second surge, we lost additional surgical volume due to PACU and OR nursing redeployments and the PACU being used for hospitalized patients. Our endoscopy volume for FY 2020 was 4,942 — a decrease of 38% from 7,924 the prior year. We are steadily recovering our volume for surgery and endoscopy this year and will slowly return to pre-COVID numbers. Our obstetric volume increased slightly, to 950 deliveries during 2020.

### BID–Plymouth Services

- Minimal-access laparoscopic surgery, including colorectal surgery
- Plastics and reconstructive surgery
- Orthopedic sports medicine
- Total and complex joint replacement
- Podiatry, ankle and hand surgery
- Cancer surgery
- Urological procedures for men and women
- Obstetrics and gynecological surgery
- ENT surgery, including outpatient pediatrics
- Vascular surgery
- Thoracic surgery
- Neurosurgery
- Orthopedic and general outpatient pediatric surgery
- Complex spine surgery
- Endoscopy surgery (ERCP planned to start in 2021)
- Cardiovascular services, including permanent pacemaker insertions



\*FY21 Proj is based on actual October 2020 through March 2021 annualized.

### Faculty

Ben Kaon, MD  
Ben Moor, MD  
James O’Rourke, MD  
Neil Oliwa, MD  
Associate Site Chief, BID–Plymouth  
Aimee Reilly, DO  
Christopher Walters, MD  
Natalia Yaromenka, MD

### CRNAs

Maria Vaz, CRNA  
Site Manager  
Randy Barnhard, CRNA  
Victoria Boehm, CRNA  
Shelby Butler, CRNA  
Dana Carey, CRNA  
Katelyn Caron, CRNA  
John Cona, CRNA  
Matthew Daube, CRNA  
Kevin Doherty, CRNA  
Brian Fenn, CRNA  
Traci Greer, CRNA  
Lauren McGrath, CRNA  
Amy Townsend, CRNA  
Peter Tsinzo, CRNA

### Nurse Practitioners

Diane White, NP  
Dawn Gellar, NP

### Anesthesia Techs

Colleen Murphy  
Maureen Vascellone  
Laurie Downing



### Pre-Admission Testing

BID–Plymouth has two nurse practitioners (NPs) who screen all patients undergoing elective surgery. Currently most of our screening is done via telephone to help promote a patient-friendly screening practice. Our total joint replacement patients and some of our more complex patients are seen in person. At these sessions, our pre-admission NPs take detailed patient histories and help educate patients regarding what to expect for their anesthetic experience. They help ensure our patients are in optimal medical condition prior to elective surgery and communicate potential issues or patient questions to anesthesiologists.



### Patient Satisfaction

We have implemented a variety of specialty-specific multimodal analgesia pathways as well as enhanced recovery after surgery, or ERAS, protocols for particular services. These include many peripheral nerve blocks to promote postoperative pain control. We instituted a same-day surgery pathway for qualified total joint replacement patients after a robust program of preoperative education involving physical and occupational therapy and nursing support. Total joint patients receive shorter-acting spinal anesthetics with sedation and receive instruction and physical and occupational therapy prior to discharge. We partnered with local VNAs to provide these patients postoperative care in their homes after surgery. The program was conceived and started prior to COVID, but was helpful in our ability to continue to perform total joint replacements at a time when hospital admissions for elective surgery were not permitted. The outpatient joint program has been a great success, and we plan to continue to grow this program and expand it to other specialties if clinically appropriate.

We provide obstetric care at BID–Plymouth and use spinal and epidural narcotics as well as multimodal techniques to provide optimal analgesia to patients undergoing cesarean sections. For obstetric patients whose pain is not controlled using the usual modalities, we offer ultrasound-guided TAP blocks.

Our patient satisfaction HCAP scores for our surgical unit are generally excellent, and we continually seek to improve patient safety and satisfaction.

### COVID-19

When the COVID-19 pandemic hit in early 2020, our team came together and did a terrific job adapting to this unprecedented clinical crisis. As a result of these efforts, we made many improvements in COVID-protection protocols and care. We participated in the BIDMC COVID simulations and adapted their protocols for airway management of patients. Preparations included donning-and-doffing training, establishing an airway team, and building temporary walls to establish a COVID-19 OR with temporary pressure systems. We also converted an obstetrics space to a negative pressure room, as we had some COVID-positive obstetric patients.





Dr. Dan Walsh, director of our BID-Plymouth intensive care unit (ICU), was very active in COVID trainings and, under his oversight, we did proning simulations, created a protocol, and conducted trainings for our nursing staff. Dr. Walsh and Dr. Burns have coordinated with anesthesia colleagues in the network and BID hospitalists to prepare for any future virus surges.

### Education

We are proud to welcome certified registered nurse anesthetist (CRNA) students from the University of New England and Boston College. Both our CRNAs and physicians are excited to offer educational opportunities to these students, including training in various regional anesthetic techniques using ultrasound. We are exploring a program for critical care fellows to offer BID-Plymouth as an elective site to further their education in a busy community ICU with 14 beds.

### Quality improvement



We have achieved great success with continual quality-improvement efforts in our orthopedic cases. We were recently given Joint Commission accreditation as a Center for Excellence in Joint Replacement and are currently pursuing the same goal for our spine surgery program.

Our department is working with the Quality Division to decrease the number of patients who are seen in the OR requiring readmission after discharge from the hospital. This effort involves clinicians across many areas of the hospital, including surgeons, hospitalists, and nurses. We are joining in a hospital-wide effort to prevent and minimize postoperative complications, including improving postoperative pain control and minimizing narcotics to prevent postoperative ileus and urinary retention.

This year we plan to implement the BIDMC Root Cause Analysis team training at BID-Plymouth in conjunction with the BIDMC Quality and Safety team. This involves extensive training of staff, who will then begin to facilitate this system in Plymouth. We plan to streamline the ongoing and regular reports of clinical members of the anesthesia department (OPPE) using data extracted from our anesthesia records and quality analysis, while using a BIDMC template across the network.





# Anna Jaques Hospital



**Chad Anderson, MD**  
Site Chief, Anna Jaques Hospital

“Anna Jaques is a great place to work with outstanding anesthesia staff. We are proud to be a part of the APHMFP family.”



## Clinical

Anna Jaques Hospital is a 120-bed community hospital located 40 miles north of Boston. Our anesthesia department is comprised of seven anesthesiologists, 10 certified registered nurse anesthetists, and one anesthesia support tech. We cover five operating rooms (ORs), three endoscopy suites and sedation in the hospital-based Pain Center. In addition, we provide obstetrical anesthesia for over 700 deliveries annually with 24/7 in-house anesthesia coverage. Our anesthesia clinicians handle, on average, 9,000 cases per year.

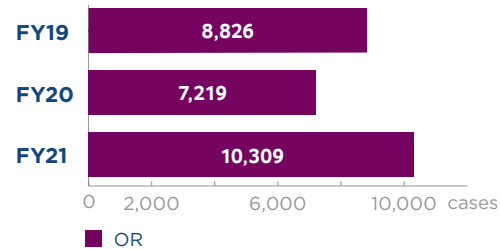
Anna Jaques joined the New England Baptist Orthopedic Program on December 11, 2019. This initiative strengthened our already robust total joint-replacement program by providing standardized protocols from pre-op to post-discharge. When the COVID-19 pandemic caused hospital capacity issues and a lack of inpatient beds, we were able to quickly transition to exclusively outpatient total joint replacements for a period of time. This was accomplished very effectively and will transform our care in the future.

We also started an enhanced recovery after surgery, or ERAS, program in collaboration with our gynecological surgeons. By providing preoperative nutrition and hydration, multimodal analgesia and streamlined anesthesia pathways, we were able to transition most of our hysterectomies to outpatient cases. On the obstetrical side, we have begun to provide anesthesia for external cephalic versions. This was done with collaboration from the BIDMC obstetric anesthesia team and is a great example of teamwork between the academic and community hospitals in our department.

## COVID-19

COVID-19 proved to be a challenge to everyone in our department on many fronts. We faced numerous obstacles, from inpatient surges and OR shutdowns to slowdowns in surgery. We were confronted with a deadly virus we knew little about and experienced anxiety about the lives and safety of our patients and transmission to ourselves and our families. But by working together, learning, adhering to safety protocols, and supporting each other, we met every challenge head-on and are able to move together into the future stronger and more united than ever.

Anna Jaques Hospital Case Volume FY19-FY21



\*FY21 Proj is based on actual October 2020 through March 2021 annualized.

## Faculty

Katherine Bourne, MD  
Vladimir Eisenberg, MD  
Jennifer Evansmith, MD  
Jessica Heath, MD  
Mark Kats, MD  
Robert Kirkman, MD  
Steven Parker, MD

## CRNAs

David Kelleher, CRNA  
Site Manager  
Ross Cerami, CRNA  
Beth Coolidge, CRNA  
Nancy Dunn, CRNA  
Beth Hughes, CRNA  
Patrick Johnson, CRNA  
Robert Martin, CRNA  
Leah Murnane, CRNA  
Kirsten Ross, CRNA  
Erin Todd, CRNA

## OR Support Tech

Melissa McCartney





# Cambridge Health Alliance



**J. Joseph Mackey, MD**  
Chief of Anesthesia, Cambridge Hospital  
Medical Director of Perioperative Services

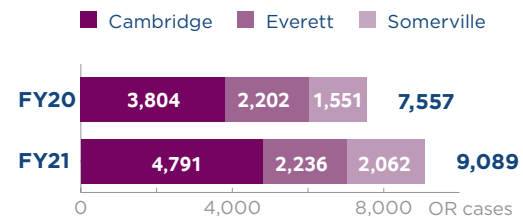
“Care to the People is our rallying cry, born from our passion to reduce barriers to care and advocate for change.”

Cambridge Health Alliance (CHA) is a group of three hospitals: **Cambridge Hospital, Everett Hospital, and Somerville Hospital.** We offer a wide range of clinical services in general medicine and most medical specialties, as well as emergency and surgical services. CHA collectively has 241 licensed beds, including 89 inpatient psychiatric beds and 13 maternity beds. At the CHA Cambridge Hospital campus, there are 128 licensed beds, including 45 inpatient psychiatric beds and 13 maternity beds. At CHA Everett Hospital campus, there are 113 licensed beds, including 44 inpatient psychiatric beds. The Somerville Hospital has an urgent care center and an endoscopy center. CHA offers clinical and surgical services across a wide range of medical specialties as well as general medicine and emergency care.

## Clinical Update

We averaged 914 cases a month (or approximately 11,000 cases per year) over approximately eight rooms per day across the three hospitals that constitute the Cambridge Health Alliance. Our team does a wide variety of case types, with the exception of cranial neurosurgery and open heart cases. We perform orthopedic surgeries, including sports, hand/elbow, total joint replacement and traumatic orthopedic injuries, as well as podiatric, gynecological, thoracic, vascular, colorectal, general and urologic surgeries. In addition, our operating rooms (ORs) serve as the site for the Cardiology Department’s pacemaker and loop recorder placements as well as the Pulmonology Department’s bronchoscopies and endobronchial ultrasound procedures. We also perform all the sedation services for the endoscopy programs across CHA.

CHA Case Volume FY20-FY21

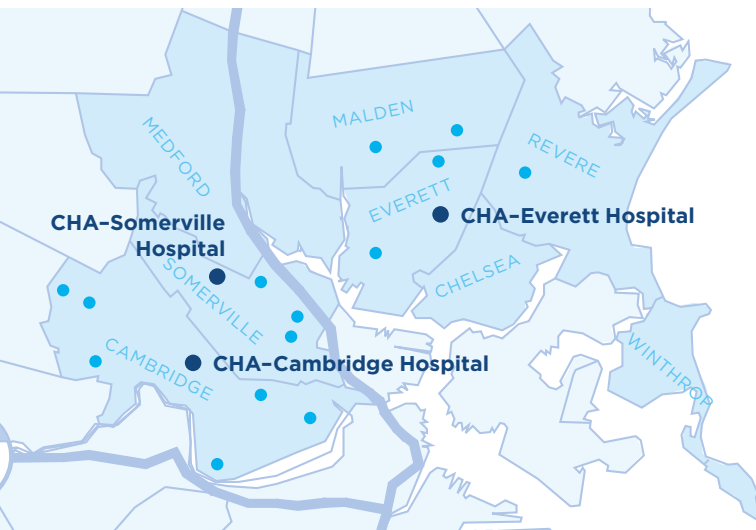


\*FY21 Proj is based on actual October 2020 through March 2021 annualized.

Finally, CHA provides anesthesia services for a robust and busy obstetrical program. We see about 1,200 deliveries a year, with an approximately 25% labor epidural rate and an approximately 29% total C-section rate.

Finally, CHA provides anesthesia services for a robust and busy obstetrical program. We see about 1,200 deliveries a year, with an approximately 25% labor epidural rate and an approximately 29% total C-section rate.

Primary Care Coverage  
● CHA Primary Care Center



## Faculty

- Matthew Bloch, MD
- Jason Erlich, MD
- Lawrence Gibbons, MD
- Donna Griffith, MD
- Sharon Herman-Berreby, MD
- Mihaela Ionita, MD
- Hemant Joshi, MD
- Anna Margulian, MD
- Jan Matejka, MD
- Lindsay Moore, MD
- Wissam Mustafa, MD
- Ross Musumeci, MD  
Vice Chair Network Anesthesia
- Katherine Nixon, MD
- Robert Qiu, MD
- Aileen Starnbach, MD  
Site Chief, Mount Auburn Hospital  
Chief Medical Officer, APHMFP Anesthesia
- Elamana (Vijay) Vijayakumar, MD
- John Wadlington, MD  
Associate Site Chief, Everett
- Jason Wang, MD
- Jessica White, MD
- Albert Woo, MD
- Annie Woon, MD  
Associate Site Chief, CHA
- Michael Young, MD  
Site Chief, New England Baptist Hospital
- Albert Woo, MD
- Sana Zaidi, MD

## CRNAs

- Juliano Barbosa, CRN
- Stacey Bettes, CRNA
- Guoli Chen, CRNA
- Minwook (Larry) Chong, CRNA
- Shannon Conley, CRNA
- Susan Cox, CRNA
- Alena Curry, CRNA
- Nicholas Ferrari, CRNA
- Kara Gulezian, CRNA
- Karapet (Kevin) Guyumozhvan, CRNA
- Kevin Lopeman, CRNA
- Febbie Manna, CRNA
- Enrique (Rick) Matta, CRNA
- Kehyla Matthews, CRNA
- Jah McLernan, CRNA
- Kaylen Parent, CRNA
- Monique Patterson, CRNA
- Catherine Reilly, CRNA  
Site Manager, CHA
- Eduardo Vargas, CRNA
- Nancy Waywood, CRNA  
Site Manager, CHA

## Administrative Coordinator

- Sandra Aurillo

## COVID-19

During the initial surge, the Anesthesia Department continued to provide services for obstetrics, labor and delivery as well as anesthesia for emergency surgeries. The Anesthesia Department created intubation/line teams to support the Critical Care teams at CHA. We performed all these procedures on COVID-19 patients, which freed up the Critical Care team to provide care and consultations in the multiple COVID-19 units across CHA. Two intubation/line teams were created: one for the Cambridge Hospital and one for the Everett Hospital. Both teams were in-house 24 hours a day, 7 days a week – a new development for the Everett Hospital, as we normally do not staff an in-house call team at that location. During the second surge, we staffed the Everett Hospital intubation/line team with an on-call team from home as there was enough lead time for team members to travel in from their home for necessary procedures.

Certified registered nurse anesthetists also staffed the intensive care units (ICUs) and surge ICUs in the initial surge as mid-level practitioners and helped extend care from respiratory therapists with vent management and blood gas analysis.

When the ORs reopened in fall of 2020, we averaged 746 cases per month in approximately eight rooms a day. The OR block times and rules governing access to these rooms across CHA had to change and are now more in line with our ongoing project to improve OR utilization. We kept one OR dedicated to COVID-positive patients at the Cambridge and Everett Hospitals and expanded anesthesia services for endoscopy at the Somerville Hospital from one room three days a week to two rooms five days a week. These COVID rules forced a much more efficient use of OR time and allowed the surgeons to follow the standard utilization rules that most institutions have in place.







## Education

**Boston College SRNA Program:** We work with student registered nurse anesthetists (SRNAs) in their initial clinical rotations and in the senior clinical rotations. This has been a very successful clinical rotation for the SRNAs, since the variety of cases matches their educational needs and the size of the institution is not overwhelming for trainees.

**Critical Care MD, Hospitalists, and Respiratory Therapist Retraining:** These providers, who may not have met their numbers for maintaining intubation privileges, rotate through the department to obtain retraining.

**Dental Residency Program:** We also host residents from the CHA Dental Residency Program for a two-week rotation to learn the basics of anesthesia. We are working with the Dental Residency Program to expand this program in order for their residents to earn a certification for the provision of anesthesia.

**Harvard Medical School Clerkship:** Third-year medical students rotate through the Anesthesia Department as part of their surgical rotation. They spend one week with us to get a brief exposure to the field of anesthesiology and its principles and practices.

**Podiatry Residency Program:** The podiatry residents at CHA rotate through the Anesthesia Department for a two-week rotation to learn the basics of anesthesia.

**ProEMS Paramedics Program:** The paramedics complete all their airway training with our department.

## Quality Improvement

We have updated our perioperative management structure to create a more cohesive and collaborative team. This effort includes our OR utilization and block management project. In addition, we are working on a medication-error reduction project that includes a syringe labeling system (Codonics) that will integrate with our EPIC medication scanning system. We have also initiated an On Time Start Project to get our first cases of the day into the OR efficiently and on time.

CHA's Outpatient Total Joint Program and Enhanced Recovery after Surgery programs are in initial stages of development, as they were delayed by the COVID-19 pandemic.





# Mount Auburn Hospital



## Aileen Starnbach, MD

Site Chief, Mount Auburn Hospital  
Chief Medical Officer, APHMFP Anesthesia

“The hospital motto ‘Excellence with Compassion’ accurately describes our approach to patient care. It is a very special place to work because it is a hybrid between community hospital and academic center.”



## Clinical

Founded in 1886 as the first hospital in Cambridge, Massachusetts, Mount Auburn Hospital is dedicated to improving the health of the residents of Cambridge and its surrounding communities. Mount Auburn Hospital is a teaching hospital affiliated with Harvard Medical School, and is the “third tertiary hub” in the Beth Israel Lahey Health system.

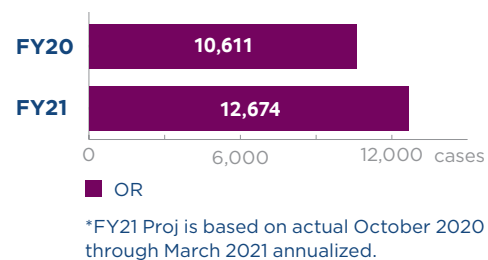
Mt. Auburn has 217 licensed beds and provides comprehensive inpatient and outpatient services in all medical specialties. We provide anesthesia services to a broad range of surgical specialties, including cardiac, thoracic, vascular, orthopedics, obstetrics/gynecology, bariatrics and urology. We also provide anesthesia support for electrophysiology procedures, interventional radiology, gastrointestinal endoscopy, and labor and delivery (2,700 deliveries annually) and ECTs.

Pre-COVID, we performed approximately 1,841 inpatient and 6,312 outpatient cases annually (FY 2019) in our main operating room (OR) and day surgical suites. In addition, we also provided anesthesia support for gastrointestinal endoscopy and ERCPs, cardiology and interventional radiology. Mt. Auburn also has a very busy obstetrics service, performing about 2,700 deliveries a year.

Our clinical case mix includes:

- General surgery (including major pancreas and liver surgery)
- Cardiac (CABG, valve repairs and replacements, TAVRs, structural heart procedures)
- Thoracic surgery (open lung resections, VATS, mediastinal masses)
- Vascular surgery (lower-extremity bypass, carotid and aortic aneurysm)
- Bariatrics
- Orthopedics (total joint replacements, traumatic injuries, sports medicine)
- Otolaryngology
- Cancer surgery
- Robotic surgery (urology, gynecology)
- Podiatry
- Plastic surgery
- Gastroenterology (endoscopy and ERCPs)
- Cardiology (EP ablations, TEE, cardioversions)
- ECTs
- Obstetrics

Mt. Auburn Hospital Case Volume FY20-FY21



## Faculty

Matthew G. Bloch, MD  
Director of Cardiac Anesthesia, MAH  
Donna Griffith, MD  
Frank Gu, MD  
J. Michael Haering, MD  
Mohammed Hassan, MD  
Associate Site Chief, NEBOCC  
Sharon Herman-Berreby, MD  
Mihaela Ionita, MD  
Hemant Joshi, MD  
Sonia Kapoor, MD  
Pei-Lin Kim, MD  
Site Chief, Boston IVF  
Philip Krapchev, MD  
Lizbeeth Lopez, MD  
Jan Matejka, MD  
Elizabeth (Lindsay) Moore, MD  
Director of OB Anesthesia, APHMFP  
Ross Musumeci, MD  
Vice Chair Network Anesthesia  
Samir Patel, MD  
Associate Site Chief, NEBH  
Director ICU, BID-Milton  
Robert Qiu, MD  
Elamana (Vijay) Vijaykumar, MD  
Jason Wang, MD  
Jessica White, MD  
Albert Woo, MD  
Rowland Wu, MD  
Associate Site Chief, MAH  
Svelta Yordanov, MD  
Sana Zaidi, MD  
Dana Zalkind, MD  
Dezhan Zhang, MD

## CRNAs

Hilary Bloom, CRNA  
Amy Bogosian, CRNA  
Joseph Casassa, CRNA  
Shannon Conley, CRNA  
Alena Curry, CRNA  
Richard Guillaume, CRNA  
Dorothy Kushmerek, CRNA  
Christine Maggs, CRNA  
Site Manager  
Febrianty Manna, CRNA  
Site Manager  
Marissa Mattei, CRNA  
Karl Mitchell, CRNA  
Kaylen Parent, CRNA  
Valerie Razis, CRNA  
Doris Schneller, CRNA  
Allan Thomas, CRNA  
Eduardo Vargas, CRNA  
Priscilla Watson, CRNA  
Nancy Waywood, CRNA

## Administrative Coordinator

Cheryl Irenne

## Anesthesia Technicians

Phil Chaput  
Lead Tech  
Whitney Bigot  
Lizette Quintilla  
Miquel Burgos  
Hancy Jean Simon



All of our physicians are expected to perform all types of cases (with exception of cardiac cases), including obstetrics. Since we don't have a separate “block team,” all staff perform ultrasound-guided nerve blocks either as the primary anesthetic or for post-op pain. This gives us the benefit of a well-prepared clinical staff with a broad repertoire of skills in clinical anesthesia. We have certified registered nurse anesthetist (CRNA) in-house coverage 24/7 to help cover our busy obstetrics service, and many CRNAs are proficient with neuraxial techniques.

## COVID-19



During the first COVID surge, all elective procedures were cancelled or postponed, and case volume dropped drastically.

Our case volume rose again during September-November until the second COVID surge started. Our approach during the second surge was less restrictive than the first surge, so fortunately we were able to perform about half of our usual surgical volume. During the second surge, our CRNAs provided support to intensive care unit nursing and respiratory therapy.





## Education

Mt. Auburn is a Harvard teaching hospital and a clinical site for residents of multiple specialties. We host five to six student registered nurse anesthetists monthly from the Boston College Nurse Anesthesia Training Program. We are also a clinical rotation site for BIDMC Anesthesia residents, typically hosting one senior resident each month. In addition, we host several podiatry residents for their anesthesia rotation.

## Quality Improvement

Our quality-improvement efforts are thorough and continuous to ensure that we provide the best care and maintain high marks for patient satisfaction. We currently have several clinical and quality and safety projects in development, each spearheaded by different members of the department:

- Enhanced recovery after surgery (ERAS) for colorectal surgery
- ERAS for urological/gynecological surgery
- Preoperative inpatient fluid management
- CONcISE in situ simulation (planning phase)





# New England Baptist Hospital



**Michael V. Young, MD**  
Site Chief, New England Baptist Hospital

“When you are here, I feel calm.”  
—a comment from an RN to one of our anesthesia MDs. As we aim to provide safe, excellent, high-quality care, this is a comment that rings true for all of our anesthesia practitioners at NEBH and is a common sentiment shared by our patients, our surgeons, our RNs, our medicine doctors, and our other colleagues in the hospital.”

## Introduction

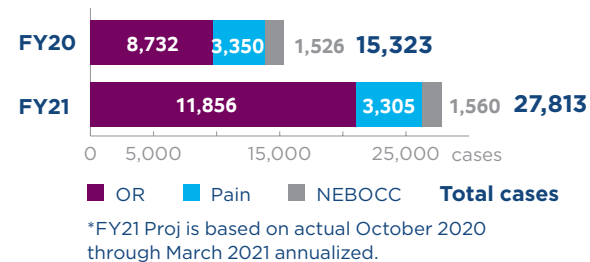
New England Baptist Hospital (NEBH) is a nationally recognized orthopedic subspecialty hospital whose mission is to promote wellness and restore function in patients with musculoskeletal diseases. For the Anesthesia Department, it is our goal and pleasure to provide high-quality and safe perioperative care in accordance with best practices to assist in the rapid recovery of our patients. Through optimal pain management, intraoperative anesthetic technique, and quality perioperative care and planning, we are able to rapidly improve the lives of our patients.

## Clinical

NEBH has 80 staffed beds between the NEBH Main Campus and New England Baptist Outpatient Surgical Center (NEBOCC) in Dedham, MA. There are 16 operating rooms (ORs) at the NEBH Main Campus and eight ORs at NEBOCC. The hospital averages about 13,500 cases per year, with 6,500 total joint replacements, 2,000 spine surgeries, over 8,000 hospital admissions, and over 5,000 sports/outpatient procedures.

Our team’s focus on increasing use of neuroaxial anesthesia whenever possible has been very successful: in 2019, regional anesthesia was used for 30-40% of hip surgeries, increasing to 90% from 2020 to the present time.

**NEBH & NEBOCC Case Volume FY20-FY21**



Despite an increased case load at NEBOCC, which is open five days a week, our team’s accomplishments over the past several years include:

- Utilizing a low-dose technique to decrease length of stay for outpatient joint procedures and decreased time to ambulation for inpatients
- Matching OR utilization to anesthesia staffing
- Developing neuraxial and regional techniques for spine surgery
- Developing an outpatient joint pathway
- Revising preoperative testing
- Developing a Quality and Safety Committee



## Faculty

- Mohammed Hassan, MD  
Associate Site Chief, NEBOCC
- Samir Patel, MD  
Associate Site Chief, NEBH  
Director ICU, BID-Milton
- Ross Musumeci, MD  
Vice Chair Network Anesthesia
- Matthew Bloch, MD
- Jason Erlich, MD
- Maher El-Katib, MD
- Miheala Ionita, MD
- Sonia Kapoor, MD
- Vladimir Kazakin, MD
- Philip Krapchev, MD
- Pei-Lin Kim, MD  
Site Chief, Boston IVF
- Katherine Nixon, MD
- Jan Matejka, MD
- Jessica White, MD
- Lisa Wollman, MD
- Albert Woo, MD
- Svetla Kurteva Yordanov, MD
- Sana Zaidi, MD
- Dezhen Zhang, MD

## Pain Faculty

- Chris Wenger, MD
- Dana Zalkind, MD

## CRNAs

- Matthew Ascione, CRNA
- Hillary Bloom, CRNA
- Amy Bogosian, CRNA
- Jessica Coxson, CRNA
- Rick Burns, CRNA  
Site Manager
- Joseph Casassa, CRNA
- Nicholas Ferrari, CRNA  
Site Manager
- Richard Guillaume, CRNA
- James Howard, CRNA
- Keegan McDonnell, CRNA
- Caitlin McManus-Vitale, CRNA
- Karl Mitchell, CRNA
- Martina O’Connell, CRNA
- Patricia Petrous, CRNA
- Tony Procopio, CRNA
- Susan Roessle, CRNA
- Kheyla Matthews, CRNA
- James McCowan, CRNA
- Megan Ruane, CRNA
- Priscilla Watson, CRNA

## Nurse Practitioner

- Lorraine Magner, NP

## COVID-19

All elective surgery was suspended at NEBH in March of 2020 during the initial wave of the COVID pandemic. Cases resumed in June of 2020, and OR utilization remained high and close to pre-COVID utilization until the second mandated suspension of elective surgery in late January 2021. While cases have resumed as of mid-February 2021, OR utilization is not quite at 100% of prior levels.



## Education

We maintain an active relationship with the nurse anesthesia program at Boston College and generally have four student registered nurse anesthetists with us at a time. In addition, we offer an anesthesia clerkship for Tufts medical students and usually have one such student per month. We have credentialed BIDMC regional fellows to allow them to rotate on our busy block service at NEBH and NEBOCC.

## Block Team

- Lyudmila Birbrayer, RN
- Reama Hawat, RN

## Anesthesia Techs

- Eileen Cadogan  
Head Anesthesia Tech
- Jean Duplessys
- Malik Layne
- Eugene Licardo
- Tyler Mattingly
- Calvin Szumierz
- Luis Vazquez

## Administrative Coordinator

- Kimberly Ann Wetherbee





## Quality Improvement



Our team continually works to improve the quality of our care and ensure our methods are based on the most up-to-date evidence in the field. We have had significant success with our internal quality-improvement projects over the past several years.

The focus of our research is primarily on internal quality-improvement projects. These include:

- **collecting** data on low-dose spinal anesthesia and its effects on time to ambulation in comparison to higher doses
- **standardizing** anticoagulation management in accordance with American Society of Regional Anesthesia guidelines and outreach with our community physicians in order to prevent insurance denial of a neuroaxial technique for surgery
- **developing** a cardiac implantable electronic device (CIED) management pathway for the OR, Post-Anesthesia Care Unit (PACU) and floor
- **transitioning** the pre-op evaluation from paper to NEBH's electronic platform

In addition, our faculty and leadership are active on NEBH committees aimed at monitoring and improving care, including the Critical Care Committee, OR Executive Committee, Block Committee, Same Day Surgery Committee, and PACU Committee.

## Conclusion

NEBH is a national leader in orthopedic care and surgery, and our anesthesia team has contributed significantly to that reputation for excellence. Our continuous efforts to raise quality further demonstrate our passionate commitment to providing the best anesthesia care to every patient. We get great satisfaction in taking a part in improving the quality of life for our patients and look forward to the continued growth of our thriving and collegial practice.







**BIDMC Anesthesia  
Clinical Divisions**



# Pre-Admission Testing



**Richard J. Pollard, MD, FASA**

Director, Pre-Admission Testing  
 Director, Quality Improvement  
 Program Director, Neuroanesthesia Fellowship  
 Assistant Professor of Anaesthesia

“It is a great honor to work with such a dedicated team of professionals to provide the best possible care for our patients.”

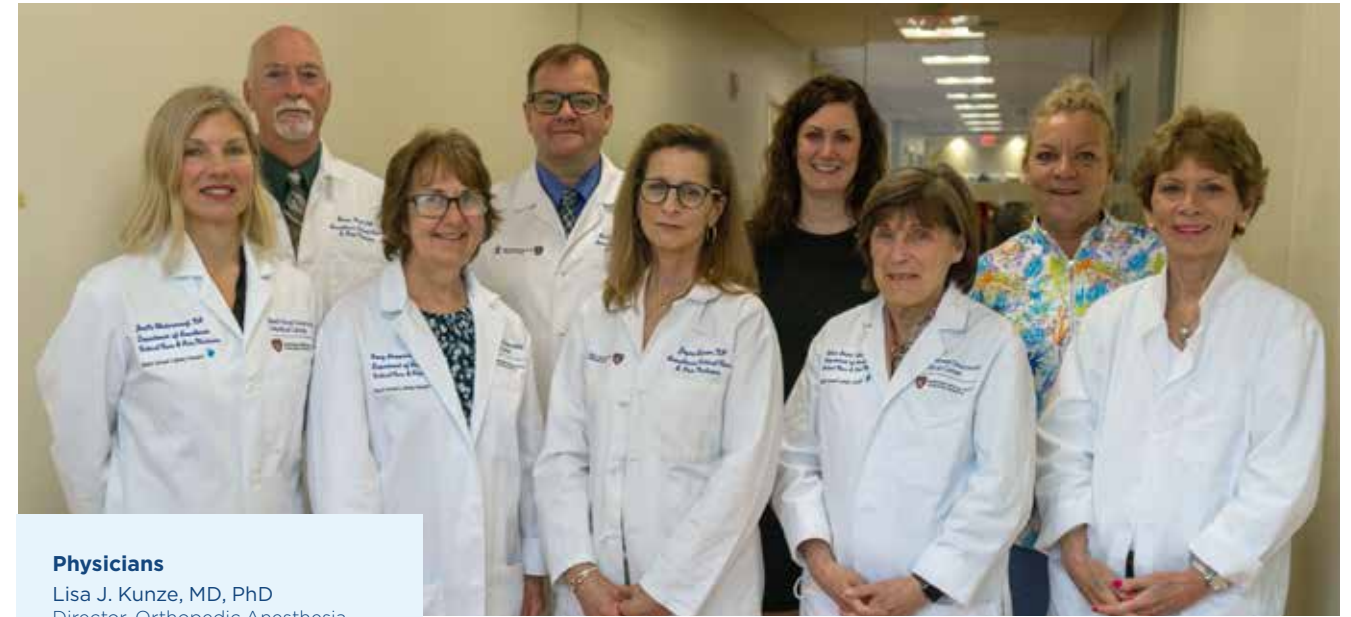
The BIDMC Pre-Admission Testing (PAT) unit is a state-of-the-art clinic that provides perioperative management of patients undergoing surgery at BIDMC. Our team does blood drawing, electrocardiogram testing, complete physical evaluations, and targeted physical therapy assessments. Our approach is multidisciplinary, and our team includes anesthesiologists, perioperative advanced practice nurses, nurses, case managers, physical therapists, medical assistants and administrative staff. The PAT mission is to ensure that patients are completely prepared for their planned anesthesia and procedure. We cover all the bases, including assessing patients’ pre-existing medical conditions, patient education, collecting chart information, and completion of all laboratory and other testing prior to the procedure. In addition, we introduce the patients to the medical center to promote a comfortable, patient-friendly experience.



In 2020, Richard Pollard, MD, was appointed the new PAT director. With over 25 years of experience in clinical anesthesia and a firm grounding in research and quality improvement, Dr. Pollard is ideally equipped to continue PAT’s tradition of excellence. He serves on the American Society of Anesthesiologists’ Committee on Patient Safety and Education.

Patients are assessed in several ways depending on their medical condition. All patients receive a telephone call from a PAT nurse to review health issues, confirm medications, and review preoperative instructions. Often, this is all patients require. Patients with more complicated medical issues are seen in the clinic by a nurse practitioner and given a pre-anesthesia assessment, history, physical exam, needed labs and testing and, if indicated, a visit with a physical therapist or case manager. If the patient has significant medical issues, clinical staff may consult a medical specialist to chart a course for things like perioperative management of anticoagulant medications or monitoring an implanted cardiac device. In cases where anesthesia poses a high risk, they might discuss the appropriateness or timing of the planned procedure with the surgeon. If a patient has a complex case but it is inconvenient for them to come in person because they live far away or due to other circumstances, we perform a “waive,” or anesthesia review. A PAT anesthesiologist conducts a thorough review of these patients’ charts and makes appropriate recommendations when necessary.

Our BIDMC PAT clinic is a bright, cheerful, patient-centered environment, but also a very busy and efficient clinic. During fiscal year 2020, we prepared 15,647 patients for procedures, with 5,044 (32.3%) coming in for in-person screening. We usually have a much higher volume, but, due to the impact of the COVID-19 pandemic, surgical procedures were significantly reduced. Our nurse practitioners and other staff were



**Physicians**

- Lisa J. Kunze, MD, PhD  
 Director, Orthopedic Anesthesia  
 Assistant Professor of Anaesthesia
- Deborah S. Reynolds, MD  
 Site Chief, Longwood Plastics  
 Assistant Professor of Anaesthesia
- Richard A. Steinbrook, MD  
 Associate Professor of Anaesthesia
- Lior A. Levy, MD  
 Director, Resident Simulation  
 Instructor in Anaesthesia

**Nurse Practitioners**

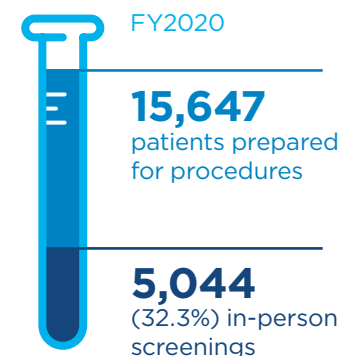
- Joelle Chateauneuf, NP
- Laura Cook, NP
- Sara Durgerian, NP
- Nicole Epolito, NP
- Bryar Hasenjaeger, NP
- Brian Hoell, NP
- Kathryn Koestner, NP
- Joyce Larson, NP
- Mary-Ellin Moore, NP
- Virginia A. Sheppard, NP
- Eileen M. Stuart-Shor, RN, AGNP-BC, PhD

redeployed to other clinical locations to provide the needed care. We also collaborated with colleagues in the quality-improvement team to create and operationalize best-practice techniques for the perioperative management of COVID-positive and suspected COVID-positive patients.

The PAT group strives to continually improve the care we provide through innovation and quality-improvement efforts. We recently updated our practice-management guidelines for patients with diabetes, cardiac implantable electronic devices, and opioid use disorders. Our expert nurses now coordinate anti-coagulant medication for all surgical patients, not just those who come to PAT. We also continue our work with the Enhanced Recovery after Surgery (ERAS) initiative and continue to enhance clinical pathways for multiple surgical specialties. In addition, we refined practice-management pathways for perioperative anticoagulation management and post-operative nausea and vomiting (PONV), and revised our pre-anesthesia orders to incorporate changes in PONV and other guidelines.

Resident education is also an important part of PAT’s mission. Our clinicians work with our trainees on the full range of issues related to pre-anesthesia testing, including cardiac risk assessment, perioperative management of pulmonary disease, cardiac implanted devices, diabetes, endocrine disorders, opioid disorders, psychiatric disorders, substance abuse and use of anti-coagulants. While PAT does not do research, we assist with recruitment of patients for the many clinical trials going on in our department.

Dr. Pollard recently completed a chapter in *Evidence-Based Anesthesia*, 4th edition, titled “Does Anesthetic Choice Affect Surgical and Recovery Time?” encouraging the use of ERAS guidelines. Dr. Pollard and his PAT team look forward to the work ahead, which is to continually improve our pre-anesthesia patient care to ensure a safe, expert and compassionate experience for our patients.





# Nurse Anesthesia



**Patricia O'Connor, CRNA**  
System Chief CRNA

“It’s a pleasure to work with the best CRNAs and care teams both at the medical center and our community sites where clinical excellence, teaching, teamwork and communication are central to the culture.”

The Division of Nurse Anesthesia comprises a group of exceptionally skilled, compassionate and resilient certified registered nurse anesthetists (CRNAs) who demonstrate unwavering dedication to patient care. Over the past several years, the division has grown along with the expansion of our department. We now have 40 CRNAs at Beth Israel Deaconess Medical Center (BIDMC) and 65 CRNAs practicing at our community settings, including BID-Needham, BID-Milton, BID-Plymouth, Anna Jaques Hospital, Mount Auburn Hospital, New England Baptist Hospital and Cambridge Health Alliance. We anticipate more growth over the coming years as we actively recruit the best CRNAs to join our thriving team of professionals.

 BIDMC  
**40** CRNAs

 Community Hospitals  
**65** CRNAs

Our CRNAs function primarily in a clinical role within our department, supporting our mission by providing efficient, high quality care for patients undergoing many types of procedures. They work within a team care model that has proven remarkably effective at providing perioperative care for patients at all acuity levels from many subspecialties.

Our work over the past two years has focused on more streamlined communication among the team and with other clinical staff, standardized clinical practice protocols across sites, and a more integrated CRNA group within the department. The result is a group that is not only clinically excellent but part of a cohesive team that works together to ensure coverage for a high volume practice with many patients who are critically ill and undergoing complex procedures.

## Division Members

- Katherine Bellanti, CRNA
- Alina Benoit, CRNA
- Joseph Bertrand, CRNA
- Scott Breitenstein, CRNA
- Jennifer Brown, CRNA
- Stephen Buchanan, CRNA
- Lorrie Jeanne Campbell, CRNA
- Elizabeth Cardone, CRNA
- Donnell Carter, CRNA
- Minwook (Larry) Chong, CRNA
- Megan Clancy, CRNA
- Timothy DeGuzman, CRNA
- Steven Demartini, CRNA
- Christine Dundon, CRNA
- Keri Goodwin, CRNA
- Donna Greene, CRNA
- Rita Han, CRNA  
SCRNA Student Coordinator
- Sarah Hayden, CRNA
- James Hogan, CRNA
- So-Min (Amy) Huang, CRNA
- Carolyn Bruce Long, CRNA
- Eileen Lyons, CRNA
- Jennifer Manning, CRNA
- James McCowan, CRNA
- Kayleigh McDonald, CRNA
- Fotini Mitsis, CRNA
- Rebecca Peyev, CRNA
- Jennifer Phelan, CRNA
- Kevin Phelan, CRNA
- Naira Qazi, CRNA
- Catherine Reilly, CRNA
- William Rice, CRNA
- Amy Runk, CRNA
- Meghan Saund, CRNA
- Ashley Vaughn, CRNA

## SPOTLIGHT ON

### Donnell Carter, CRNA



CRNA Donnell Carter is not only a superb clinician but a committed humanitarian whose work on behalf of making a world a better, kinder and healthier place has ranged far and wide, from Liberia and Rwanda in Africa and back to the United States.

Donnell awarded the **2021 Janice Drake Humanitarian Award** from the American Association of Nurse Anesthetists (AANA) for his work on behalf of the AANA Foundation and other charitable organizations.

He has been a huge supporter of the Boston Africa Anesthesia Collaborative run by Elaine Stuart-Shor, RN, PhD, both as an active volunteer and a fundraiser. As part of that program, he traveled to Phebe Hospital in Liberia to work with their nurse anesthetist program and has mentored Liberian CRNAs who have come to BIDMC for training. He also uses his social media platform to raise money for the program during holiday fundraisers.

Donnell also went on a mission to Rwanda organized by the International Organization for Women and Development [www.iowd.org](http://www.iowd.org), a non-profit charity dedicated to providing free specialized surgery and care to women in low income countries. The Rwandan program sends teams of OB/GYN physicians, surgeons, nurses, and CRNAs several times a year to evaluate women and determine appropriate candidates for surgery, mainly for the fistulas that result from early childbearing and lack of OB/GYN resources but also for other gynecological issues. Donnell’s team was there for eight days and they did 4-6 surgeries per day. “The conditions are grueling for the clinicians due to the hot weather, unsophisticated medical resources, and the language barrier which makes it difficult to communicate with patients. But this was a deeply rewarding experience to help these women get surgery that is life-changing and sometimes life-saving and improves the quality of their lives”

Here in the US, Donnell works with the Biomedical Science Career Program as a mentor for young men and women interested in science-based careers, and also mentors new nurses entering the ICUs and PACUs and students as part of a Diversity in Nurse Anesthesia program. As a certified master nutritionist and certified personal fitness trainer, Donnell is committed to helping people live healthier and more active lives. He led 44 individuals to lose a combined 644 pounds by creating a ‘challenge’ and regularly speaks to groups about using healthy lifestyle, wellness, and self-care as a way to preventative health. Donnell says “I’m pretty passionate about this. My goal is to combine 30 years of healthcare experience with my certifications to help people live healthier lives.”

Nurse Anesthesia	
Case Volume	
FY18	8,878
FY19	8,074
FY20	10,888
FY21 Proj	11,693





## COVID-19

During the COVID-19 surges, our CRNAs took on new and expanded roles in our department. Throughout the hospital network, they responded to this crisis by putting their knowledge and skill to critical use, functioning as airway teams, advanced-practice providers in surge intensive care units, and as respiratory therapists. Their superb work and dedication to going the extra mile has saved lives and helped us to excel during this clinical crisis that threatened to overwhelm our health care systems.

## Education

In addition to clinical practice, our CRNAs are committed to the education of trainees in their field. As clinical instructors, they mentor student nurse anesthetists from Boston College and Northeastern University. This program is long standing and we recruit many of the new graduates to our department. We expect continued strengthening of our partnerships with these institutions as we welcome more trainees to BIDMC in the coming months.

Our division's commitment to education extends to the global sphere as well. As part of the Boston-Africa Anesthesia Collaborative, we hosted three faculty nurse anesthetists from the Phebe School of Anesthesia in Liberia over the past two years, and for the first time sent a Boston CRNA to Phebe. We also facilitated 12 virtual grand rounds with our Liberian CRNA colleagues throughout the first COVID surge and continue to work with faculty at Phebe to foster online education opportunities and provide funding for much-needed supplies and equipment. We look forward to hosting more Liberian visitors and sending our own faculty to Liberia when we can resume global travel.

## Special projects

Our CRNAs are also active with departmental projects related to clinical issues as well as use of new technologies. They have assisted with creation of an emergency manual and clinical pathways and served on the task force responsible for implementing Talis, our new medical record system.

## Culture

Our department provides a unique culture for CRNAs who are fully valued for their professional skill and offered considerably flexibility in practice settings. We offer practice at BIDMC, a large academic medical center, as well as at many community settings, so our CRNAs have the opportunity to choose either one site or a hybrid model to meet their practical needs, preferences, and clinical interests. No matter where they practice, our team enjoys the department's culture of mutual respect and collegiality.

We have enormous pride in and respect for the talented CRNAs in our Division of Nurse Anesthesia and are grateful for their expert care for our patients as we continue to grow in both numbers and excellence.

### Supporting nurse anesthetist education in Liberia through COVID-19 and beyond

Two years ago, under the strategic development and Leadership of our PAT nurse, Eileen Stuart-Shor, NP, PhD, the Boston-Africa Anesthesia Collaborative (BAAC) was formed. This important global health initiative works to help Liberia build an in-country, self-run nurse anesthesia school to increase the capacity for trained anesthetists to provide safe anesthesia. The BAAC has had significant impact building a growing support community that now includes 30 locations across Africa.

Before COVID-19 halted travel, the BAAC brought Liberian CRNA faculty from the Phebe School of Nursing in Liberia to BIDMC for a month of advanced training in anesthesia care. As part of the program, visiting faculty from Phebe also rotated at Boston Children's Hospital and Northeastern University School of Nursing. The BAAC also sent sponsored clinicians from our Department to Liberia to provide training and support at Phebe. The BAAC has made major progress toward helping Liberians create a self-sustaining nurse anesthetist program in Liberia, where anesthesia services are desperately needed.

When COVID-related travel restrictions began in 2020, Director Eileen Stuart-Shor, PhD, NP worked to keep the BAAC moving ahead even without in-person visits.

Dr. Stuart-Shor, along with US colleagues, hosted weekly online Grand Rounds with Liberian nurse anesthetists colleagues which grew to include 30 different areas of Africa. They offered continuing educational support as well as individual mentoring sessions and resources to help the Liberians prepare for the COVID-19 pandemic based on our experiences here treating these patients.



In addition to academic and clinical support, the BAAC provides financial resources to offset the cost of anesthesia training in Liberia. The BAAC with the support of the Department, created a fundraising campaign at the end of 2019, which has continued through 2021. The ongoing campaign has raised over \$30,000 which has helped Phebe School of Nursing in several ways:

- They were able to repair the school van that takes students to clinical placements, allowing students to travel to multiple hospitals with higher surgical volume (ensuring students have enough cases to meet graduation requirements and attend emergency cases). Despite COVID-19, Phebe was able to graduate 10 students thanks to the repaired van.
- They created an online learning platform and trained faculty to teach online. This helped students continue to learn during the COVID lockdown and allows them to have a mechanism for clinical mentoring when students are away on clinical placements.
- They received three two-year scholarships for the incoming 2021 Liberian nurse anesthetist class this fall.

The BAAC is honored to do this life-saving work and looks forward to bringing over the next cohort of Liberian Anesthetists for training. If you would like to donate to this program, please visit <http://bit.ly/LiberianCRNAProgram>.





# Cardiac Anesthesia



**Feroze-Ud-Den Mahmood, MBBS**  
 Director, Cardiac Anesthesia  
 Director, Perioperative Echocardiography  
 Professor of Anaesthesia

“Our world renowned perioperative 3D TEE service and training programs continue to compliment the growth and reputation of our cardiac surgical service.”

Members of the division of cardiac anesthesia provide robust clinical services to a diverse group of challenging patients across the medical center and the network.



## Clinical

Traditionally, a case was considered “cardiac” when it involved use of cardiopulmonary bypass or high risk of going on bypass, but developments in the field have significantly broadened our specialty. The Division of Cardiac Anesthesia now handles many cases that were previously not considered exclusively cardiac, particularly with the evolution of percutaneous structural heart disease interventions, ventricular assist devices and complex electrophysiological procedures. As a result, the scope of our clinical practice has significantly expanded.

Our open surgical volume has continued to expand, despite the pandemic, and we are on course to perform 800-900 open cardiac surgical procedures for the fiscal year. We perform 150-200 mitral valve procedures in a year, and our medical center has established a reputation as a “mitral surgery center” with a broad and growing referral base. Our surgeons also started an “aortic valve repair” program with a growing volume and complexity of cases. Most of these surgical procedures are driven by real-time three-dimensional transesophageal echocardiography (3D TEE) guidance, exclusively provided by the members of our division. Our perioperative 3D TEE service and training is considered one of the most prestigious and well-known programs in the world and has continued to complement the growth and reputation of our cardiac surgical service. In addition to our TEE expertise, our division has received the highest-quality composite star rating by the Society of Thoracic Surgeons in multiple domains.

Our Structural Heart Disease program is growing and thriving under the expert leadership of our interventional cardiology team. In the last fiscal year, we performed 224 transcatheter aortic valve replacements; 80 edge-to-edge percutaneous mitral valve repairs; 20 percutaneous tricuspid valve repairs; and 50 cases of para-valvular leak closures, atrial appendage occlusion, atrial and ventricular septal defect closure and valve-in-valve therapies. These procedures are entirely driven and guided by 3D TEE exclusively provided by the members of our division. Besides 3D echocardiography, our cardiac anesthesiologists are also able to perform fluoroscopy, computed tomography and magnetic resonance imaging for real-time procedural guidance.

Cardiac Anesthesia	FY18	FY19	FY20
<b>Case Volume</b>			
<b>Total Cases</b>	<b>2,173</b>	<b>2,089</b>	<b>2,248</b>
Pump Cases	803	843	655
Structural Heart Cases	262	294	224



## Division Members

**Ruma R. Bose, MD, MBBS**  
 Program Director, Adult Cardiothoracic Fellowship  
 Assistant Professor of Anaesthesia

**J. Michael Haering, MD**  
 Vice Chair, Clinical Affairs  
 Assistant Professor of Anaesthesia

**Anastasia Katsiampoura, MD, PhD**  
 Instructor in Anaesthesia

**Megan L. Krajewski, MD**  
 Instructor in Anaesthesia

**John D. Mitchell, MD**  
 Vice Chair, Education  
 Director, Center for Education Research, Technology and Innovation  
 Associate Professor of Anaesthesia

**Mark J. Robitalle, MD**  
 Instructor in Anaesthesia

**Sankalp Sehgal, MD**  
 Section Head of Anesthesia for Electrophysiology  
 Instructor in Anaesthesia

**Shahzad Shaefi, MD, MPH**  
 Vice Chair, Professional Affairs  
 Medical Director of Venovenous Extracorporeal Membrane Oxygenation (VV ECMO)  
 Associate Professor of Anaesthesia

**Aidan M. Sharkey, MD**  
 Instructor in Anaesthesia

**Balachundhar Subramaniam, MD, MPH**  
 Director, Sadhguru Center for a Consciousness Planet  
 Ellison “Jeep” Pierce Chair of Anaesthesia at BIDMC  
 Professor of Anaesthesia

**Sugantha Sundar, MBBS**  
 Director for Professional Affairs  
 Assistant Professor of Anaesthesia

The heart failure service at the medical center has grown exponentially over the last few years. Members of the cardiac division also provide anesthetic services to patients undergoing ventricular assist device implant/explant, extracorporeal membrane oxygenation therapy and complex electrophysiological procedures.

With the incorporation of the medical center into the Beth Israel Lahey Health Network, the activities of the cardiac division have expanded, and we now participate in cardiac cases at the Mount Auburn Hospital and collaborate with the Cardiac Division at the Lahey Clinic.

## COVID-19

Cardiac surgical volume was significantly impacted by the restrictions initiated as a result of the COVID-19 pandemic. However, due to the semi-urgent/urgent nature of cardiac surgery and availability of rapid testing, we continued to perform cardiac surgeries through most of the lockdown phase of the pandemic. Like all medical centers, we had an initial large decrease in our case volume, but the number of cases has since picked up, and currently we are at or near full operating capacity. During the pandemic, beside their clinical duties, members of our division volunteered their services to the COVID-19 intensive care units and other designated COVID-19 facilities throughout the state of Massachusetts. As a division, we also developed and practiced protocols and procedures for patients with COVID-19 requiring urgent and emergent cardiac surgery. In collaboration with cardiac surgical and operating room staff, our staff demonstrated the highest level of clinical excellence while maintaining personal safety and minimizing exposure. During this pandemic, our division members have admirably continued their clinical responsibilities while maintaining their customary level of excellence as clinical teachers, scientists and innovators.



## SELECTED PUBLICATIONS

Katsiampoura A, Tuttle M, Sharkey A, Huang L, Baribeau V, Mahmood F, Bose RR. Fluoroscopic Imaging for the Interventional Echocardiographer. *J Cardiothorac Vasc Anesth*. 2021. PMID: 34301448.

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Mahmood E, Matyal R, Mahmood F, Xu X, Sharkey A, Chaudhary O, Karani S, Khabbaz K. Impact of Left Atrial Appendage Exclusion on Short-Term Outcomes in Isolated Coronary Artery Bypass Graft Surgery. *Circulation*. 2020. PMID: 32489114

## Research

Our division has an impressive and varied research portfolio, and multiple members of the division are involved in groundbreaking basic science, clinical and outcomes research. As a group, we have created a culture of professional respect, embracing change, fostering innovation and encouraging research. Our division members have always demonstrated a unique synergy between research and clinical operations by integrating translational bench-to-bedside and mechanistic bedside-to-bench research.

Members of our division are principal and co-investigators on multiple National Institutes of Health and foundation grants:

- Dr. Subramaniam has multiple ongoing clinical trials regarding use of acetaminophen and multimodal analgesia for delirium protection.
- Dr. Shaefi participates in multiple research projects regarding prevention of acute kidney injury in patients undergoing cardiac surgery.
- Drs. Matyal and Sharkey participate in multiple basic science projects regarding neo-angiogenesis in diabetic cardiomyopathy, regional anesthesia for enhanced recovery after cardiac surgery and nanoparticle-based remote drug delivery.
- Drs. Sharkey, Sehgal and Mahmood participate in multiple research projects examining 3D reconstruction and imaging of mitral and tricuspid valves and matching of intra-cardiac hemodynamics with SHD interventions.
- Dr. Mahmood participates in the multicenter, ongoing SHD AccuCinch®, Triluminate® and JenaValve® trials.

The multidisciplinary and collaborative Valve Research Group is active in multiple research projects regarding 3D imaging and SHD simulators, 3D printing, motion metrics during complex tasks, point of care ultrasound and pre-clinical proficiency in perioperative ultrasound.

In addition to mentoring residents and fellows presenting abstracts at national meetings, division members have published multiple manuscripts in prestigious peer-reviewed journals: more than 70 peer-reviewed manuscripts and 10 book chapters were published by division members in recent fiscal years. Dr. Sehgal won the Best of Meeting Abstract at the Society of Cardiovascular Anesthesiologists (SCA) Annual Meeting for his research on the tricuspid valve.

## Education

Under the leadership of Dr. Ruma Bose, our adult cardiothoracic anesthesia (ACTA) fellowship program has expanded from two to four fellows. It is considered one of the most prestigious ACTA fellowship programs, with hundreds of applicants for four positions. Dr. Bose has



introduced multiple innovations in the curriculum, including SHD, heart failure and electrophysiology rotations for the ACTA fellows. She is also transforming the fellowship didactics into online and interactive learning modules that incorporate metrics of knowledge gain and competence. Under her guidance, our cardiac anesthesia fellows have participated in regional and national conferences and presented their fellowship research projects.

Dr. Bose has also initiated a six-month, one-of-its-kind SHD fellowship that trains cardiac anesthesiologists as “invasive echocardiographers” for procedural guidance during SHD interventions. Our division has already graduated two SHD fellows and recruited multiple candidates for future fellowship training. The establishment of this fellowship has cemented the position of our division as the leader in SHD education and training. As the next step, we will introduce the framework for a structured national curriculum for the SHD fellowship and possibly expand the fellowship to two fellows.

Using a state-of-the-art phantom heart model, Drs. Bose and Katsiampoura have created a program for introduction to fluoroscopy for cardiac anesthesiologists and another 3D simulator-based training program for quantification of 3D imaging. Additionally, we have the only TEE simulation laboratory in the country, which conducts multiple ongoing educational projects for residents, fellows and outside physicians. In collaboration with Dr. Mitchell, we have conducted two ultrasound training courses for United States Navy SEALs. These are groundbreaking and original educational research projects conducted by the members of our division.

Our faculty members also participate in significant national teaching. Dr. Mahmood leads the prestigious SCA Echo Week, Drs. Sharkey and Krajewski were elected to the Echo Week program committee and Dr. Robitaille participated as faculty on the course. Dr. Sugantha Sundar leads the Annual Harvard Review Course as the course director, and multiple members of the division participate as course faculty. Dr. Shaefi is part of the program committee of the SCA Annual Scientific Sessions and runs the critical care track educational lectures.

In the coming years, we plan to upgrade our fleet of echocardiography equipment to support the increasing complexity of SHD interventions. The division members are also in the planning phase of restarting the Boston Echo Course as a Harvard Medical School continuing medical education course in 2022.

## Quality Improvement

Division members participate in departmental and hospital-wide quality improvement (QI) initiatives and multiple ongoing QI projects, including an early extubation protocol and a transfusion reduction project.



# Gastrointestinal Anesthesia



**Soumya Mahapatra, MD**  
 Director, GI Anesthesia  
 Instructor in Anaesthesia

“Providing the best and safest anesthesia care to every patient is our goal.”

The volume of anesthetics administered outside of our traditional operating rooms has continued to rise in recent years, with a particular increase in cases in gastroenterology (GI). All staff anesthesiologists, certified registered nurse anesthetists, and NPs contribute to care in this area, with a core group rotating through GI more frequently to provide consistent and local expertise.

## Clinical

The department currently staffs five GI suites on the East Campus and two GI suites on the West Campus in the West Procedural Center. Gastroenterology represents our most active remote location — we provide anesthesia for over 10,000 cases annually. Beth Israel Deaconess Medical Center (BIDMC) has one of the busiest advanced GI units in the country, and the availability of our anesthesia services and the expertise of our providers have been instrumental in the steady growth of this unit. The types of cases routinely performed include ERCP, small bowel enteroscopy, esophageal ultrasound, minimally invasive treatment of Barrett’s esophagus and the gastric “poem” (peroral endoscopic myotomy) procedure for gastroparesis.



During 2020, there was a slight decrease in the total volume of GI cases due to the impact of the COVID-19 pandemic. During the virus surges we cancelled or postponed most routine endoscopies and colonoscopies, performing only cases that were considered urgent or time-sensitive. GI cases are high-risk, aerosol-generating procedures, which required close collaboration with our department’s quality and safety division to create safety protocols to minimize transmission risk to all involved.

GI Anesthesia	FY18	FY19	FY20	FY21 Proj
<b>Case Volume</b>				
<b>Total Cases</b>	<b>12,357</b>	<b>12,437</b>	<b>10,194</b>	<b>11,748</b>

## Research

Together with our GI partners, there have been multiple joint publications on a number of topics, such as MAC anesthesia versus general anesthesia. Our endoscopy unit has been featured in several panels and abstracts at national anesthesia meetings.



## Education

The Division of Gastroenterological Anesthesia trains our residents and fellows in the full range of GI anesthesia services. Trainees rotate in our GI suites and gain essential experience in caring for patients undergoing procedures in these units.

## Quality Assurance

The Division of Gastroenterological Anesthesia is committed to consistent monitoring and patient care to improve outcomes. Quality-improvement activities are ongoing and span both clinical care and operations. Our current projects include:

- All adverse outcomes and complications are closely followed and presented in the department’s Morbidity and Mortality conferences for discussion and analysis. We collaborate closely with our department’s Quality and Safety Division to ensure safe and world-class care for all our patients.
- Division leadership worked on a project during 2020 that analyzed the financial justification for adding one more anesthetizing location in the GI suites on both the East and West campuses. As a result of this work, we have already added one more anesthesia location to the GI suite on the West Campus, and we will add one on the East Campus in the coming months.
- We are working on improving on-time starts in the GI suites. This involves identifying the factors driving late starts and collaborating with colleagues and clinical staff to implement solutions. Since late starts lead to considerable overtime work, we hope that improving times will lead to better staff satisfaction and use of anesthesia resources.

## Conclusion

We expect that the current trend of increased need for anesthesia services outside the traditional OR venue will continue to rise, particularly in the specialty of GI. As demand for our services grows, we are committed to meeting these needs and fully prepared to deliver the complex range of anesthesia services required by BIDMC GI patients.





# Neuroanesthesia



**Samir M. Kendale, MD**  
Division Director, Neuroanesthesia  
Member of the Faculty

“We are paving the way to the finest modern neuroanesthesia through collaboration, research, and clinical excellence.”

The Neuroanesthesia Division delivers anesthesia services for the full range of spine surgery — from minimally invasive to complex functional neurosurgery, neuromodulation and epilepsy surgery, intracranial tumors (various types and locations, awake and asleep anesthetic approaches), and open and endovascular cerebrovascular procedures. The division welcomed a new director in 2020: Samir Kendale, MD, an experienced clinician and research investigator from NYU Langone Health. He joins a stellar group of clinicians and scientists who have experience in areas such as quality, education and critical care. Dr. Kendale looks forward to continuing to use this wealth of expertise to shape the division internally as well as utilize the support of the rest of the department.

## Clinical

The division maintains an excellent level of care for the high volume of patients for cerebrovascular procedures that we continue to see in both the operating room and in the interventional neuroradiology suite. For open cerebrovascular cases, we have been working with the operating room nurses to ensure that the anesthesia team has a view of the surgical field via a large screen that displays the microscope. This helps us to anticipate hemodynamic management in response to clipping, bleeding and rupture.

With the arrival of new neurosurgeons who focus on various brain tumors, we have seen an increase in complex tumor surgeries. Skull base surgeries, such as transphenoidal pituitary surgery and resections of acoustic neuromas, are commonly performed in conjunction with ENT surgeons and require an understanding of the impact of tumor location on physiology and attention paid to timely and smooth emergence. Surgery for tumors in the speech areas are now frequently performed while a patient is awake, necessitating a unique anesthetic technique, careful positioning and constant open communication between the anesthesiologist, neuromonitoring teams and the patient.



We are seeing an increase in the use of intraoperative neuromonitoring, particularly for both neurosurgical and orthopedic spine surgeries. Many of these patients have significant medical issues, including severe

Neuro Anesthesia	FY18	FY19	FY20	FY21 Proj
<b>Case Volume</b>				
Intracranial	500	478	437	381
Spine	383	483	370	399
<b>Total Cases</b>	<b>1,216</b>	<b>1,492</b>	<b>1,313</b>	<b>1,346</b>



## Division Members

**Somnath Bose, MD, MBBS**  
Site Director for Critical Care at BID-Needham  
Assistant Professor of Anaesthesia

**Lauren K. Buhl, MD, PhD**  
Associate Program Director, Anesthesia Residency  
Instructor in Anaesthesia

**Akiva Leibowitz, MD**  
Director of ENT Anesthesia  
Assistant Professor of Anaesthesia

**Soumya Mahapatra, MD**  
Director, GI Anesthesia  
Instructor in Anaesthesia

**Kadhiresan R. Murugappan, MD**  
Instructor in Anaesthesia

**Sara E. Neves, MD**  
Program Director, Anesthesia Residency  
Instructor in Anaesthesia

**Achikam Oren-Grinberg, MD, MS**  
Director of Critical Care Echocardiography  
Assistant Professor of Anaesthesia

**Ameeka Pannu, MD**  
Program Director, Anesthesia Critical Care Fellowship  
Instructor in Anaesthesia

**Richard J. Pollard, MD, FASA**  
Director Pre-Admission Testing  
Director, Quality Improvement  
Director, Neuroanesthesia Fellowship  
Assistant Professor of Anaesthesia

**M. Leo Tsay, MD**  
Director, Non-Anesthesia Trainees  
Instructor in Anaesthesia

myelopathy or chronic pain syndromes that require complex anesthetic management plans and benefit from advanced monitoring. We aim to increasingly incorporate EEG monitoring during these cases to limit anesthetic exposure, help with clear neuromonitoring signals, and provide safe emergence and extubation, allowing for rapid neurologic assessment.

## COVID-19

Because many neurosurgical procedures typically cannot be delayed, late-era COVID-19 restrictions on elective procedures (as of July 2020 onward) did not have a dramatic impact on case volumes, except for functional neurosurgery. Most tumor and cerebrovascular surgeries, and some spine surgeries, could not be postponed without significant advancement of disease.

## Research

Dr. Richard Pollard currently has a clinical trial on the impact of dantrolene on spine surgery patients that has been very successful thus far with recruitment. We look forward to the completion of this study and its results.

## SELECTED PUBLICATIONS

Esmaeeli S, Valencia J, Buhl LK, Bastos AB, Goudarzi S, Eikermann M, Fehnel C, Pollard R, Thomas A, Ogilvy CS, Shaefi S, Nozari A. Anesthetic Management of Unruptured Intracranial Aneurysms: A Qualitative Systematic Review. *Neurosurg Rev.* 2021. PMID: 33415519

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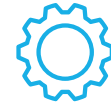
Montoya-Gacharna J; Kendale SM. Traumatic Brain Injury. In: Scher CS, Kaye A, Liu H, Perelman S., eds. *Essentials of Blood Product Management in Anesthesia Practice.* New York, Springer, 2021.







## Education



**Teaching and mentoring:** The neuroanesthesia rotation continues to be one of the most popular rotations among residents, due in large part to the online resources available through the Moodle platform, the hands-on teaching provided by the faculty and the “Longitudinal Oral Board Exam” conducted individually with each resident on the rotation through an online message board. A testament to the success of the rotation is the increasing number of residents who demonstrate an interest in pursuing a neuroanesthesia fellowship after graduating, as is the involvement of residents in a number of neuroanesthesia projects. Under the guidance of Dr. Lauren Buhl, Dr. Matthew Vengalil wrote a podcast for the Society for Neuroscience in Anesthesiology and Critical Care (SNACC), Dr. Nathaniel Sugiyama is working on the Neuroanesthesia Classroom project on the Trainee Engagement Committee at SNACC, and Dr. Chris Koo wrote a podcast on cerebral protection for Anesthesia Toolbox.

**Fellowship program:** We are interviewing for the 2021-22 academic year. We are impressed with the quality of the candidates and expect to welcome an exceptional fellow to our neuroanesthesia team.

## Quality Improvement

Our division has a number of quality-improvement projects underway aimed at enhancing both patient care and satisfaction. We are formalizing handoffs for craniotomies, developing enhanced recovery protocols for spine surgery and adult spine deformity surgery, creating an educational program for post-anesthesia care unit nurses on postoperative care of neurosurgical patients and writing case-management tips for our anesthesiologist colleagues.

In addition, our team members are involved in Beth Israel Lahey Health system committees for the establishment of the Neurosciences Service Lines, which includes workgroups for both neurooncology and epilepsy. Our early involvement in these committees will allow the department to have a voice in the development of these services and be prepared for any changes to our care that may occur as a result of the expansion of these clinical areas. Neuroanesthesia Division members are also involved in the Society for Neuroscience in Anesthesia and Critical Care.

## Conclusion

As the field of neuroanesthesia evolves, our division will continue to adapt and grow along with changing surgical and anesthetic techniques and approaches. Our goal is to maintain our pace of growth along with the rest of the field, and we will accomplish this by updating our anesthetic management, expanding our research program, perfecting our quality measures and perioperative protocols, and continuing to deliver high-quality, world-class care to the wide spectrum of patients that come to our facilities.





# Obstetric Anesthesia



**Yunping Li, MD**  
Division Director, Obstetric Anesthesia  
Associate Professor of Anaesthesia

The obstetric service at Beth Israel Deaconess Medical Center (BIDMC) is a major tertiary referral center and the second-largest delivery unit in Massachusetts. The Division of Obstetric Anesthesia is an integral part of the obstetric team and includes 15 full- and part-time staff. Our physicians are nationally recognized in obstetric anesthesia and leaders in cutting-edge clinical and basic science research and innovation. We provide personalized, world-class anesthesia care to both healthy pregnant women and high-risk obstetric patients requiring complex care. Our team strives to give each and every patient the best labor and delivery experience possible and to keep childbirth safe, comfortable and free of complications as they welcome their infants into the world.

## Clinical

Our department provides the entire range of obstetric anesthesia care necessary in a modern teaching hospital with a high volume of labor and delivery cases. Our services include:

- Anesthesia consultation
- “Walking” labor epidural (low-concentration local anesthetics)
- Analgesia/anesthesia for operative vaginal delivery and cesarean delivery
- Anesthesia for non-obstetric surgery in pregnant women
- Anesthesia for fetal procedures
- Individualized care for high-risk pregnant women, including patients with cardiac, pulmonary and hematologic comorbidities and opioid use disorder
- Multidisciplinary and precise care for patients with placenta accreta spectrum
- Consultative and collaborative services for postpartum complications, such as massive hemorrhage, congestive heart failure or neurologic deficits
- Post-delivery visit to every patient

OB Anesthesia	FY18	FY19	FY20
<b>Delivery Type</b>			
Cesarian Deliveries	1,712	1,687	1,574
Vaginal Deliveries	3,544	3,680	3,406
<b>Total Cases</b>	<b>5,256</b>	<b>5,367</b>	<b>4,980</b>

We take great pride in our individual achievements as a division as well. Obstetric Anesthesia at BIDMC was awarded the Society for Obstetric Anesthesia and Perinatology Center of Excellence in 2019. Our center was one of the first 39 institutions in North America to receive this designation.



## Members

- Vimal K. Akhouri, MD, MBBS, ISc**  
Assistant Professor of Anaesthesia
- Erin J. Ciampa, MD, PhD**  
Instructor in Anaesthesia
- Meredith I. Colella, MD**  
Instructor in Anaesthesia
- Victoria M. Derevianko, MD**  
Site Chief, BID-Milton  
Instructor in Anaesthesia
- Josephine Maria Hernandez, MD**  
Member of the Faculty
- Philip E. Hess, MD**  
Executive Vice Chair, Anesthesia  
Program Director, Obstetrical  
Anesthesia Fellowship  
Associate Professor of Anaesthesia
- John J. Kowalczyk, MD**  
Section Head of Anesthesia for  
Gynecologic Surgery  
Instructor in Anaesthesia
- Lior A. Levy, MD**  
Director, Resident Simulation  
Instructor in Anaesthesia
- Patsy J. McGuire, MD**  
Instructor in Anaesthesia
- Stephen D. Pratt, MD**  
Assistant Professor of Anaesthesia
- Andrey Rakalin, MD**  
Director, Regional Anesthesia  
Instructor in Anaesthesia
- Aidan M. Sharkey, MD**  
Instructor in Anaesthesia
- Joan E. Spiegel, MD**  
Assistant Professor of Anaesthesia
- Justin K. Stiles, MD**  
Director, Medical Student Education  
(until 2020)  
Instructor in Anaesthesia
- Maria Borrelli, DO**  
2020-21 OB Anesthesia Fellow  
Joining as Attending in August 2021
- Gidget Hunter**  
Administrative Coordinator,  
East Campus
- Jannette Stephenson**  
Obstetric Anesthesia Technician



## COVID-19

The battle against COVID-19 brought enormous challenges to us as individuals, as an organization, and in our community. The pandemic put extraordinary pressure on our dedicated physicians, nurses and staff – and our division responded with courage, skill, and a commitment to keeping our patients and staff safe.

The COVID-19 pandemic poses multiple unique challenges for Labor and Delivery (L&D) Units, such as caring for COVID-19 and non-COVID-19 pregnant patients simultaneously on the same unit; in addition, mode of delivery cannot be pre-determined and emergent cesarean delivery is sometimes necessary. Therefore, strategies and guidelines are needed to protect pregnant patients and health care workers from viral transmission while at the same time ensuring safe and swift responses to obstetric emergencies. Throughout the pandemic, we learned an enormous amount about how to provide safe obstetric care. In collaboration with the Department of Obstetrics and Gynecology, and our Division of Quality, Safety and Innovation, we have reported and shared our strategies and guidelines in *Anesthesia and Analgesia, Maternal Fetal Medicine*. This workflow for COVID-19 cases is the centerpiece of guidelines to ensure standardized practice and maximized safety.

We took care of several hundred pregnant women with COVID-19 during the first and second waves of the pandemic. Our standardized protocols and guidelines translated into excellent maternal and neonatal outcomes. Numerous women were admitted to L&D with severe COVID-19 requiring supplemental oxygen; four pregnant women were admitted to the intensive care unit due to impending respiratory failure; three of them were intubated. They all recovered and delivered healthy babies.



“The best care begins on labor and delivery.”



## Research

The Obstetric Anesthesia Division is actively involved in clinical and basic science research activities to enhance knowledge of the care of the pregnant women. These research activities include investigations:

- To improve the educational program
- To better understand the physiologic changes of pregnancy
- To investigate molecular mechanisms responsible for the onset of parturition
- To improve the safety and clinical care of the parturient

Division members regularly publish peer-reviewed articles, chapters and reviews. Abstracts from our division are regularly selected for competition in the Best Papers Awards at Society for Obstetric Anesthesia and Perinatology (SOAP) meetings. The division has a strong presence at SOAP.

**Current active studies and grants:** (See OB Research Section)

## Education

A core function of the Division of Obstetric Anesthesia is the education of students, trainees and ourselves. The division trains medical students from countries all around the world as part of the Harvard Medical School clerkship. In addition, the division provides 100% of the residency training in obstetric anesthesia, as required by the Accreditation Council for Graduate Medical Education (ACGME). Finally, the division maintains ongoing educational and advanced programs for the staff. These programs are designed to provide ongoing education and improve the capabilities of each member. Some of our teaching and training programs:

- Visual Teaching Board — organized and structured daily talks. In 2020, more than 300 lectures were given by attendings, fellows, residents and medical students
- Thromboelastography training and certification — each attending and fellow has completed the training
- Point-of-care ultrasound in obstetrics — developed training models and simulation courses to train staff
- Ongoing real-time and simulation training — management of massive hemorrhage and placenta accreta spectrum
- Clinical teaching — via organized and impromptu lectures, supervised hands-on training and provision of reading materials. Residents receive initial training in obstetric anesthesia during the first six months of their residency. All first-year residents are assigned to an orientation week of obstetrics anesthesia, where they learn the basic skills of neuraxial anesthesia and analgesia and the management of a routine obstetrics patient. The purpose of this introductory week is to allow the resident to gain confidence in their foundational skills so they can learn advanced patient care during subsequent required rotations.

We thank all of our colleagues for their amazing adaptability and resilience in the stressful times of the COVID-19 surges.



After orientation, all residents are assigned a basic obstetric anesthesia rotation. During this month-long rotation, the residents hone their techniques of neuraxial anesthesia and analgesia, learn how to manage a healthy parturient, and are exposed to high-risk cases.

All residents go through a second, month-long rotation during their second year. In addition to providing more training in the care of high-risk parturients, this month includes a one-week rotation in the Neonatal Intensive Care Unit (NICU). Residents learn about care of the high-risk neonate in a level-3 NICU by participating in care with the neonatology attending and fellow. We also provide an elective third-year advanced rotation where the residents are expected to participate in the care of high-risk and complex parturients, conduct consultations and learn the management of postpartum conditions or complications, such as placenta accreta spectrum.

## ACGME-Accredited Fellowship

The Department of Anesthesia, Critical Care and Pain Medicine at BIDMC offers two positions of one-year ACGME-accredited fellowships in obstetric anesthesia. The fellowship combines advanced clinical training with ample opportunities for clinical research and residency education, providing coordination of educational, clinical and investigative research activities. The faculty includes not only dedicated obstetric anesthesiologists but also training and consultation with intensivists, cardiologists, obstetricians, maternal fetal medicine specialists, neonatologists and pathologists, who are each integral to the fellow's education program. Our Obstetrics Anesthesia Fellows complete several required and elective rotations throughout the year:

- Transthoracic echo and point of care ultrasound
- Transfusion medicine and blood bank
- Maternal fetal medicine
- Neonatal intensive care
- Clinical research
- Elective global health - as one of the major organizing institutes of the No Pain Labor and Delivery Global Health Initiative program

The fellowship didactic curriculum embraces lessons from fundamental physiology and pharmacology through the advanced science of genetic polymorphisms and molecular mechanisms of diseases during pregnancy. Fellows meet for a weekly didactic session with a faculty member.



## Major Lectures

### Philip Hess, MD

- Cardiac Disease in the Parturient. 48th Harvard Medical School Anesthesia Review and Update, Harvard Medical School CME Course. (2019)
- Converting Labor Analgesia to Cesarean Anesthesia. Lecture at 52nd Annual Meeting of the Society for Obstetric Anesthesia and Perinatology. Online due to COVID-19. (2020)

### Yunping Li, MD

- Practice Guidelines for Obstetric Anesthesia: Lectures on “Current International Guidelines,” a collaborative project with the Chinese American Society of Anesthesiologists and the new Youth Anesthesia Forum. CME lectures in China. Online audience: 3,851. (2019)
- Enhanced Recovery after Cesarean (ERAC). Keynote speaker and moderator on “Global Lecture Serial #6 – Enhanced Recovery after Surgery (ERAS).” Hosted by Hengrui Medicine. Virtual Lecture. Online audience: 143,700. (2020)

## Quality Improvement

The division is committed to thorough and continuous quality improvement. Virtually 100% of patients are seen on the first postpartum day, and quality assurance (QA) data is recorded for each visit. Our QA dashboard allows us to focus improvement efforts with greater precision. We have met and exceeded all quality standards as set by MassHealth Maternity and the Joint Commission perinatal care measures.

Our efforts allow us to provide the highest-quality post-cesarean section pain control via multimodal approaches, including neuraxial opioids, epidural analgesia, parenteral pain medication, transversus abdominis plane block and quadratus lumborum block, if indicated. In 2020, we provided formal consultation prior to delivery to 244 pregnant women for high-risk conditions, including severe scoliosis; hematologic conditions; cardiac, pulmonary and neurologic diseases; placenta accreta spectrum; and supra-morbid obesity.

Our fellows have initiated and participated in many quality improvement (QI) and QA projects that we have integrated into institutional structures for patient safety. “Enhanced Recovery after Cesarean Delivery” and “Guidelines for Patients on Unfractured Heparin” were two completed projects by our former fellows. Currently, Obstetric Anesthesia Fellow Dr. Maria Borrelli is leading a multidisciplinary QI project, along with Maternal-Fetal Medicine and Transfusion Medicine fellows, titled “Examining Peripartum Blood Transfusion Practices at BIDMC.” Dr. Borrelli and her colleagues are reviewing all cases of red blood cell transfusion (on labor and delivery and ante/postpartum floors) from 2017 to 2019 at BIDMC. She is also investigating the incidence of avoidable transfusions and transfusion complications during this time. The goal is to use this data

## SELECTED PUBLICATIONS

Ciampa EJ, Hess PE. Hypertension, Preeclampsia, and Eclampsia. In: Principles and Practice of Maternal Critical Care. Editors: Einav S, Weiniger CF, Landau R. Cham Switzerland. Springer International Publishing AG. 2020. ISBN 978-3-030-43476-2.

Ciampa EJ, Liu N, Stiles J, Carani JL, Li, Y, Hess PE. Heterozygote Carriers of Mutations in the F11 Gene, Encoding Factor XI, Have Normal Coagulation by Thromboelastography During Pregnancy. *Int J Obstet Anesth.* 2020. PMID: 31791878.

Hess PE, Wylie BJ, Golen T, Shainker SA, Zera C, Li Y. Keeping Pregnant Patients Safe During COVID-19 Pandemic. *Matern-Fetal Med.* 2020 (Editorial).

Kimaresan A, Shapeton AD, Yuan H, Hess PE. Transthoracic Echocardiographic Assessment of the Right Ventricle Before and After Cesarean Delivery: A Preliminary Investigation. *Anaesth Intensive Care.* 2020. PMID: 32106692.

Kowalczyk JJ, Carvalho B, Collins J. Transnasal Humidified Rapid-Insufflation Ventilatory Exchange for Elective Laryngeal Surgery During Pregnancy: A Case Report. *A A Pract.* 2019. PMID: 31592829

Kowalczyk JJ, Evers A. Pregnancy and Hypertension. In: Chu L, Traynor A, eds. *Manual of Clinical Anesthesiology.* 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2020.

Li Y, Ciampa EJ, Zucco L, Levy N, Colella M, Golen T, Shainker SA, Lunderberg JM, Ramachandran SK, Hess PE. Adaptation of an Obstetric Anesthesia Service for the Severe Acute Respiratory Syndrome Coronavirus-2 Pandemic: Description of Checklists, Workflows, and Development Tools. *Anesth Analg.* 2021. PMID: 33315601.

Sween LK, Xu S, Li C, O'Donoghue MA, Ciampa EJ, Kowalczyk JJ, Li Y, Hess PE. Low Dose Intravenous Dexmedetomidine Reduces Shivering Following Cesarean Delivery. *Int J Obstet Anesth.* 2020. PMID: 33293185.

to create a multidisciplinary postpartum transfusion protocol that limits avoidable transfusions and transfusion complications.

Our division offers several training and learning opportunities during regularly scheduled faculty hours aimed at improving quality of care. We offer a six-module comprehensive training curriculum in point-of-care ultrasound in obstetric anesthesia that includes physics/knobology; transthoracic echocardiogram; lung and gastric ultrasound; focused assessment with sonography for trauma, or FAST; neuraxial ultrasound with online training; live model simulation; hands-on training in clinical settings; case studies; and post-training tests. We also conduct a monthly case presentation that provides a platform for sharing clinical pearls in the management of complex cases and updating advances in obstetric anesthesia.

## Leadership/Committees

National: **Philip Hess, MD** – Society for Obstetric Anesthesia and Perinatology, Chair of Research Committee





# Orthopedic Anesthesia



**Lisa J. Kunze, MD, PhD**  
 Director, Orthopedic Anesthesia  
 Assistant Professor of Anaesthesia

“Despite diminished surgical volume due to COVID-19, our division has had impressive clinical accomplishments and innovations and steadily worked to improve our clinical outcomes and quality of care.”

Fluctuations in the operating room (OR) schedule related to COVID-19 had a significant impact on the number of orthopedic procedures in our division in 2020. While elective procedures were greatly reduced, orthopedic trauma and oncology services have remained busy. Despite diminished surgical volume, our division has had impressive clinical accomplishments and innovations and steadily worked to improve our clinical outcomes and quality of care.



## Clinical

In summer of 2020, we welcomed our first outpatient total joint arthroplasty (TJA) patients, and by fall these patients were recovering and being discharged from our Shapiro Post-Anesthesia Care Unit (PACU). The success of this process is the result of considerable work from our nursing and physical therapist colleagues.

One anesthesia-related change that has helped the outpatient TJA program is customization of the spinal anesthetic. The drug and dose for spinal anesthesia is often tailored to the knee or hip, as well as the patient, surgeon, and surgical approach. Now many of the patients receive mepivacaine for the spinal anesthetic, which reduces the risk of urinary retention and post-operative hypotension but is rather short-acting. For that reason, the risk of intraoperative conversion to general anesthesia with mepivacaine is always anticipated, and a few patients have required this conversion. In addition, these patients may have pain earlier in recovery in the PACU.

The orthopedic anesthesia team has done a stellar job achieving outpatient TJA by customizing spinal anesthesia and through consistent use of multimodal analgesia and tranexamic acid. A small number of outpatient TJA patients still require general anesthesia. There is some debate in the current literature about whether general or spinal anesthetic is preferred for outpatient TJA. Most outpatients are ASA 1-2 and tend to be younger, so the cardiovascular and mortality benefits of spinal anesthesia may not be as clear. We will continue to track this effort with our patients and follow the international trends and guidelines.

Orthopedic Anesthesia	FY18	FY19	FY20	FY21 Proj
<b>Case Volume</b>				
Elective	4,675	4,835	3,777	3,565
Trauma	1,195	1,152	1,120	1,129
<b>Total Cases</b>	<b>5,870</b>	<b>6,087</b>	<b>4,897</b>	<b>4,694</b>



## Division Members

- Vimal K. Akhouri, MD, MBBS, ISc**  
Assistant Professor of Anaesthesia
- Amanda K. Anastasi, MD**  
Assistant Professor of Anaesthesia
- Olaoluwakitan Awolesi, MD**  
Director, Medical Student Education  
Instructor in Anaesthesia
- Hyun Kee Chung, MD**  
Instructor in Anaesthesia
- Meredith I. Colella, MD**  
Instructor in Anaesthesia
- Jeffrey K. Jankun, MD**  
Assistant Professor of Anaesthesia
- Rikante O. Kveraga, MD**  
Vice Chair, Network South  
Site Chief, BID-Needham  
Assistant Professor of Anaesthesia
- Soumya Mahapatra, MD**  
Director, GI Anesthesia  
Instructor in Anaesthesia
- Patsy J. McGuire, MD**  
Instructor in Anaesthesia
- Victor Polshin, MD**  
Instructor in Anaesthesia
- Lindsay A. Rubenstein, MD**  
Associate Program Director,  
Anesthesia Residency  
Instructor in Anaesthesia
- Justin K. Stiles, MD**  
Director, Medical Student Education  
Instructor in Anaesthesia
- Eswar Sundar, MBBS**  
Director, Clinical Operations  
-East Campus  
Assistant Professor of Anaesthesia
- M. Leo Tsay, MD**  
Director, Non-Anesthesia Trainees  
Instructor in Anaesthesia
- MaryAnn Vann, MD**  
Assistant Professor of Anaesthesia
- Scott D. Zimmer, MD**  
Director, Categorical Internship  
Director, Wellness and Mentoring  
Instructor in Anaesthesia

## Research

Our division is participating in the Successful Aging After Elective Surgery (SAGES) study. Our role is to collect spinal fluid for analysis of multiple inflammatory markers in our joint-replacement patients. With the closing of Beth Israel Deaconess Medical Center (BIDMC) ORs during the COVID-19 surge in 2020, many total-joint-replacement patients received their new joints at New England Baptist Hospital (NEBH), another hospital in our network. This disruption of elective total joint arthroplasty has slowed down our work on the SAGES study, since some patients were lost to the study due to the relocation of their surgeries. The SAGES study has been extended and we are back on track with collecting spinal fluid samples for this research.

There remain several issues we must overcome in order to continue to improve the success of our patient TJA program. Urinary retention and postoperative orthostatic hypotension continue to be problematic for 20-30% of these patients. Early this year we convened a multidisciplinary group to study and hopefully reduce orthostatic hypotension. The new group is called the “Salt-Lick” group as a nod to the observation that salt is missing from the common snacks and foods provided to patients. Even the saltines have no salt. Salt tablets have been used to treat heat exhaustion and can be effective at treating symptoms of dizziness, so perhaps sodium is the key. Since other pharmacological methods have proven ineffective in preventing orthostatic hypotension, we plan to study sodium intake and other factors.





## Education



Our discussions with Emergency Department physicians about use of the fascia iliaca block (FIB) have led to an effort to expand our interdepartmental ultrasound education program. Our director, Dr. Lisa Kunze, has participated in workshops to train emergency medicine residents on basic ultrasound and the FIB. We are early in this process and recruiting educational specialists from orthopedics and regional divisions to help lead this effort.

## Quality Improvement

- Orthopedic surgery welcomed a new chairperson, Dr. Ken Rodriguez, this past year. With his guidance, along with Dr. Jack Wixted and Dr. Sarah Berry (from BIDMC Geriatric Medicine), and Dr. Max Schafer, we have created the “Hip Fracture Group.” This new committee is evaluating causes of readmissions of hip arthroplasty and hip fracture patients and developing updated practices for perioperative care of these patients. Readmissions of hip arthroplasty and hip fracture patients are extremely costly and difficult for the patient, so the efforts of this group will provide economic benefit to BIDMC and will improve patient care. We collected baseline data showing that the average time from admission to arrival in the OR for a hip fracture patient is about 40 hours. Patients who have surgery within 48 hours have lower morbidity and mortality, so we are on target, but aim to improve our performance with the data and recommendations of this group.
- We have also instituted use of intraoperative tranexamic acid (TXA) and routine use of FIB in hip fracture patients. Since anemia and transfusion adversely affect these patients, we hope TXA will help reduce both. Timely FIBs reduce mortality and are a simple procedure that can be done in most patients. Our Emergency Department colleagues have been doing a study on the FIB in hip fracture patients that is on hold due to COVID but is set to resume as the clinical situation allows. In the future, our goal is to have all patients with hip fracture receive their first FIB in the emergency department.
- The next anesthesia-related initiative in the hip fracture project is increased use of spinal anesthesia for hip fracture patients — a broad-ranging effort, since all of our clinicians care for these patients. We plan to initiate a research study to chart our progress in this area. Use of educational materials as well as the support of our department experts will provide us with significant assistance in this initiative. We already perform well in this area, since many anesthesia providers already use spinal anesthesia at BID-Milton, BID-Needham, and BIDMC, but we hope to improve further. One of the most important parts of the hip fracture project is monitoring the impact of any changes in patient outcomes. Dr. Max Schaefer brings a wealth of knowledge to our group from his recent database research of hip surgery patients, so his skills in this area will be critical to our success. Our Quality Initiative Director Dr. Krish Ramachandran and his staff will assist with data collection and reporting.
- Our group has also created a new order that must be placed by the anesthesia provider after spinal anesthesia to prevent use of anticoagulant and antiplatelet medications (other than acetylsalicylic acid and NSAIDs) for 12 hours after neuraxial anesthesia. The goal is to reduce risk of epidural hematoma.

## Conclusion

Despite the significant disruptions in elective surgeries caused by the surges in COVID-19, our division has had two years of accomplishment and continued our progress toward evidence-based improvements in caring for patients who receive orthopedic surgery. We look forward to getting our volume back to normal as 2021 progresses and providing expert and compassionate care to our patients.





# Regional Anesthesia and Acute Pain Service



**Andrey Rakalin, MD**  
 Division Director, Regional Anesthesia and Acute Pain Service  
 Program Director, Regional Anesthesia Fellowship  
 Instructor in Anaesthesia

The Division of Regional Anesthesia and Acute Pain Service at Beth Israel Deaconess Medical Center (BIDMC) was established in 2008 to improve patient care, safety and comfort through pharmacologic interventions, neuraxial anesthesia and peripheral nerve blocks. We have continued to provide high-quality care to patients across all surgical subspecialties. The importance of the division was highlighted during the COVID-19 pandemic, since many surgical procedures can be successfully accomplished under regional anesthesia, avoiding airway manipulation and aerosolization of potential virus particles. Regional anesthesia continues to play an important role in decreasing reliance on opioids and contributing to excellent patient outcomes at BIDMC.

## Clinical

There are 12 faculty members and a full-time nurse practitioner in our division. These clinicians perform the majority of blocks for surgical procedures and serve as consultants in managing acute pain. The daily regional team on the East and West campuses consists of one faculty member and an assigned resident or a fellow. This dedicated block service has greatly increased the volume and quality of regional anesthesia performed at BIDMC and led to an increase in patient and surgeon satisfaction as well as more requests for regional anesthetics. Additionally, the regional teams provide a consultation service for patients with acute post-procedural pain across both BIDMC campuses.

## Our goals:

- Continue to provide best patient care, utilizing regional techniques as part of perioperative pain management
- Continue to develop best practices to provide standardized quality patient care
- Continue to improve residents' and fellows' education in order to graduate consultants who will excel in the field of regional anesthesia and acute pain management
- Continue to contribute to the field of regional anesthesia and acute pain management by taking part in research

Regional Anesthesia	
Case Volume	
FY18	4,587
FY19	5,436
FY20	4,021
FY21 Proj	3,693



## Division Members

- Vimal K. Akhouri, MD, MBBS, ISc  
 Assistant Professor of Anaesthesia
- Amanda K. Anastasi, MD  
 Assistant Professor of Anaesthesia
- Hyun Kee Chung, MD  
 Instructor in Anaesthesia
- Meredith I. Colella, MD  
 Instructor in Anaesthesia
- Lisa J. Kunze, MD, PhD  
 Director, Orthopedic Anesthesia  
 Assistant Professor of Anaesthesia
- Mahmoud Labib, MD  
 Instructor in Anaesthesia
- Robina Matyal, MBBS  
 Director, Vascular Anesthesia  
 Leonard Bushnell Chair of Anaesthesia at BIDMC  
 Associate Professor of Anaesthesia
- Victor Polshin, MD  
 Instructor in Anaesthesia
- Lindsay A. Rubenstein, MD  
 Associate Program Director,  
 Anesthesia Residency  
 Instructor in Anaesthesia
- Justin K. Stiles, MD  
 Instructor in Anaesthesia
- Scott D. Zimmer, MD  
 Director, Categorical Internship  
 Director, Wellness and Mentoring  
 Instructor in Anaesthesia
- Regina Champagne, NP
- Kimberley Brown  
 Fellowship Coordinator
- John Bordlee, MD  
 2020-2021 Fellow

## YOUNG RESEARCHER

### Victor Polshin, MD



Dr. Victor Polshin joined our faculty in 2019, focusing on regional anesthesia and acute pain medicine as well as thoracic anesthesia. He received his medical degree from Boston University School of Medicine and went on to do his anesthesia residency at Maimonides Hospital in Brooklyn. He also completed a fellowship in anesthesia and acute pain medicine at Montefiore Medical Center in New York.

Using a retrospective perioperative BIDMC database, he worked with Dr. Matthias Eikermann and Dr. Peter Santer to analyze the benefit of peripheral nerve blocks on care of ambulatory surgical patients. The resulting article was accepted by the *Journal of Regional Anesthesia and Pain Medicine*. Currently Dr. Polshin, along with Dr. Eikermann and migraine specialist Dr. Sait Ashina, is working on a retrospective cohort study to determine if peripheral nerve blocks improve discharge outcomes for patients with diagnosis of migraine headache. He is also collaborating with Dr. Robina Matyal to develop a protocol for the care of vascular patients undergoing lower-extremity amputations, which now includes multimodal pain therapy with peripheral nerve block and peripheral nerve block catheters. Another current project involves work with a plastic surgeon and with Dr. Robina Matyal, director of vascular anesthesia, to determine if peripheral nerve blocks and peripheral nerve catheters improve blood flow for patients undergoing microvascular free flap surgery.







## COVID-19

During the COVID-19 pandemic, the regional team was essential in helping to minimize the use of general anesthesia. This undoubtedly resulted in decreased exposure of patients and staff to potentially aerosolized virus particles. Many procedures were successfully accomplished using regional anesthesia and minimal sedation. During peak months of the pandemic, when orthopedic surgery volume decreased, several division faculty volunteered to help cover clinical services at Boston Hope – a temporary field hospital set up to specifically care for underserved patients affected by the COVID-19 pandemic.

Our volume in Acute Pain Service has remained steady despite the COVID-19 pandemic. We perform close to 4,000 regional anesthetics every year. Many of these patients are complex, and we work to improve their care and decrease the use of opioids. Our Nurse Practitioner, Regina Champagne, has been in the forefront of educating nurses and orthopedic services on perioperative pain management of complex patients.

## Research

Our division is working on several ongoing research studies:

- Dr. Kunze was instrumental in establishing BIDMC as a participating site in the Successful Aging after Elective Surgery, or SAGES, Study and has worked closely on this study with researchers from other Boston and US institutions.
- Dr. Polshin is active in projects regarding improved recovery room length of stay with regional anesthesia and improving perfusion and pain control during graft surgery with Dr. Arriyan Dowlatshahi.
- Dr. Akhouri has introduced an innovative project in collaboration with general surgeons on using botulinum toxin for TAP block injections in order to improve outcomes after component separation and ventral hernia repair surgery.
- Dr. Matyal has published a paper on the benefit of erector spinae plane blocks in thoracic surgery. Erector spinae blocks have become a popular pain-control option for breast surgery as well, and we continue to refine the best workflow for patients to ensure timely and appropriate pain control.
- Dr. Labib is working on a collaborative effort with general and plastic surgeons to improve patient experience.

## Education

The regional anesthesia rotation completed by CA2 and CA3 residents is one of the most popular rotations in our residency program. First-year residents are customarily introduced to regional blocks during their first pain management rotation. However, Dr. Scott Zimmer leads a lecture series and a workshop to introduce anesthesia interns to regional anesthesia techniques and topics, resulting in much earlier exposure. Our graduates are proficient in the use of neuraxial anesthesia and



ultrasound-guided regional anesthesia for a wide variety of surgical procedures. Education Lab training is available with computer-assisted peripheral block models, as well as thoracic and lumbar epidural models with modifiable difficulty. Dedicated ultrasound and video tutorials ensure that junior residents have an appropriate level of basic regional anesthesia knowledge and skills prior to starting their rotation.



The Regional Fellowship training program has expanded to two fellows in the 2021-2022 academic year. It traditionally consists of six months of advanced regional anesthesia training combined with six months of work as an attending anesthesiologist and is available to residents who wish to pursue an in-depth interest in regional anesthesia. Our fellows contribute to resident education as well as research projects. Starting April 1, 2021, the fellows will rotate through New England Baptist Hospital – a premier orthopedic hospital in the Beth Israel Lahey Health network.

Our Regional Anesthesia Division is one of the main organizers of the ultrasound course for the Harvard Anesthesiology Update and has presented similar refresher courses nationally and internationally.

## Quality Assurance

During the pandemic, COVID-19 has had a huge impact on decision-making with regard to many clinical issues. Our division has made a contribution to this effort and worked with hospital committees to optimize care of all patients during this crisis. We are developing a comprehensive hip fracture pathway that will cover all phases of this surgery, an effort led by Dr. Lisa Kunze, director of orthopedic anesthesia. Through regional interventions, we can improve morbidity and mortality of the geriatric patients presenting for corrective surgery after falls. This process involves collaboration with surgeons, anesthesiologists and emergency room physicians and staff.

Additionally, members of the division have participated in several initiatives to improve timeliness of the operating room first-start cases. Other projects include ongoing evaluation of erector spinae plane blocks for breast surgery and the development of a nerve block quality-improvement database.

## Conclusion

The Regional Anesthesia and Acute Pain Service Division is essential to providing quality care to patients who increasingly prefer our method of pain management to other methods. Our goal is to continue to expand the use of regional anesthesia when appropriate and provide the best care possible to every one of our patients. We are bringing these best care practices into the future by training our residents and fellows to become experts in a wide range of regional anesthetics and acute pain management. In addition, we support our colleagues by helping them to maintain proficiency in our techniques and serving as consultants to surgical and medical colleagues in managing acute pain.





# Thoracic Anesthesia



**Maximilian Schaefer, MD, DESA**  
 Division Director, Thoracic Anesthesia  
 Director of the Center for Anesthesia  
 Research Excellence (CARE)  
 Assistant Professor of Anaesthesia

“The level of support, respect, openness, and enthusiasm from every member of the multidisciplinary combined thoracic surgery and interventional pulmonology team make me proud and happy to come to work.”

## Clinical

The Thoracic Anesthesia Division provides anesthesia services to patients undergoing thoracic surgery and interventional pulmonology procedures at multiple locations within the Beth Israel Deaconess Medical Center (BIDMC) network. In 2019 and 2020, we provided services for 1,598 patients. Typical procedures include flexible and rigid bronchoscopic procedures involving stent placement, cryo- and laser ablation, and surgical resection of the lung due to cancer, including open and video-assisted (VATS) procedures. Furthermore, the Chest Disease Center at BIDMC has become a leading institution in the treatment of tracheobronchomalacia, drawing patients from across the country to BIDMC. The Thoracic Anesthesia Division provides care for this challenging patient collective during bronchoscopic evaluation, stent placement and complex surgical procedures including posterior tracheobronchoplasty. These interventions require close collaboration between the anesthesia team and the surgeons. Finally, the minimally invasive thoracic surgery program has greatly advanced over the last two years, and an increasing number of endoscopic procedures, such as minimally invasive esophagectomy, pose specific and interesting challenges for anesthesia management.

Our services include general and regional anesthetics; the use of conventional mechanical ventilation and high-frequency jet ventilation; advanced airway management, including intraoperative lung isolation and single-lung ventilation; and intraoperative bronchoscopy and the management of complex airways and advanced lung disease. In close collaboration with the Regional Anesthesia Division, we supplement general anesthesia with neuraxial and peripheral anesthesia techniques such as thoracic epidural anesthesia, ultrasound-guided erector spinae block or intercostal nerve block. A recent retrospective analysis has shown that success for thoracic epidural anesthesia in our institution is 80% (Levy et al., Evaluation of Early Postoperative Intravenous Opioid Rescue as a Novel Quality Measure in Patients who Receive Thoracic Epidural Analgesia: A Retrospective Cohort Analysis and Prospective Performance Improvement Intervention. BMC Anesthesiol. 21, 120 [2021]), which is 10% higher than the success rate provided in the literature. Nonetheless, along with the Regional Division, we continually strive to further enhance the effectiveness of our blocks and neuraxial anesthesia through ongoing training of residents and attendings.

Thoracic Anesthesia	FY18	FY19	FY20	FY21 Proj
<b>Case Volume</b>				
<b>Total Cases</b>	<b>1,698</b>	<b>1,748</b>	<b>1,484</b>	<b>1,080</b>

## Division Members

- Amanda K. Anastasi, MD**  
Assistant Professor of Anaesthesia
- Ruma R. Bose, MD, MBBS**  
Program Director, Adult  
Cardiothoracic Fellowship  
Assistant Professor of Anaesthesia
- Somnath Bose, MD, MBBS**  
Site Director for Critical Care  
at BID-Needham  
Assistant Professor of Anaesthesia
- Jessica M. Cassavaugh, MD, PhD**  
Instructor in Anaesthesia
- Sapna Govindan, MD**  
Section Head for ECT  
Instructor in Anaesthesia
- Jeffrey K. Jankun, MD**  
Assistant Professor of Anaesthesia
- Anastasia Katsiampoura, MD, PhD**  
Instructor in Anaesthesia
- Megan L. Krajewski, MD**  
Instructor in Anaesthesia
- Robina Matyal, MBBS**  
Director, Vascular Anesthesia  
Leonard Bushnell Chair of  
Anaesthesia at BIDMC  
Associate Professor of Anaesthesia
- John B. Pawlowski, MD, PhD**  
Co-Director, Shapiro Simulation  
Assistant Professor of Anaesthesia
- Riccardo Pinciroli, MD**  
Instructor in Anaesthesia
- Victor Polshin, MD**  
Instructor in Anaesthesia
- Deborah S. Reynolds, MD**  
Site Chief, Longwood Plastics  
Assistant Professor of Anaesthesia
- Mark J. Robitalle, MD**  
Instructor in Anaesthesia

## COVID-19

The COVID-19 pandemic posted great challenges for our division. As a respiratory virus, this pathogen is prevalent in the upper and lower airways and can be aerosolized during procedures where these are manipulated. Therefore, virtually all anesthetics used in thoracic surgery and interventional pulmonology are high-risk for exposure and transmission of the virus. Particularly at the beginning of the pandemic, the high uncertainty about aerosolizing procedures and the effectiveness and availability of personal protective equipment put a lot of stress on the team. We are proud to say that every member of the division has stepped up and continued to provide safe and excellent care for our highly vulnerable patients, supported by the personal protective equipment that was invaluable in the fight against COVID-19. The division directed considerable attention to aerosolizing procedures, tracheostomy and management of ventilation and has contributed to the development and implementation of protocols to avoid staff exposure and ensure maximum safety for our staff and our patients.

## New Division Director

In January 2021, Maximilian Schaefer was appointed the new division director of Thoracic Anesthesia, replacing Dr. John Pawlowski, who stepped down voluntarily to focus on clinical work and to pursue his interest in medical education. Dr. Schaefer is an established clinician-scientist with a strong background in clinical research. He joined the Department in January 2019 from the University Hospital Duesseldorf, Germany, where he divided his time between the intensive care unit and the operating room, performing cardiothoracic, vascular and major abdominal anesthesia. His scientific and clinical goals are to develop and implement strategies for avoiding postoperative pulmonary complications, which are life-threatening events that occur in up to 30% of patients undergoing thoracic surgery. These strategies will be integrated into an enhanced recovery after thoracic surgery protocol, which is being developed in close collaboration with the Thoracic Surgery Department. Under his leadership since January 2021, the division commenced a series of initiatives to further develop the strong education section of the division and to empower non-division attendings in initiating and managing one-lung ventilation during on-call hours.





## Research

The Thoracic Anesthesia Division serves vulnerable patients with a high comorbidity burden who are at extraordinary risk of developing severe postoperative complications, such as pneumonia, hypoxemia and respiratory failure requiring emergent intubation. A growing body of evidence suggests that the anesthesiologist plays an important role in preventing these life-threatening complications by applying strategies such as intraoperative lung-protective ventilation. However, we are only beginning to understand how these strategies can be applied to our patients. It is our goal to provide excellent patient care through the active development of evidence-based strategies to avoid postoperative pulmonary complications. As part of this initiative, a series of studies are investigating how mechanical ventilation during one- and two-lung ventilation can be individualized to protect the lungs of our patients. These studies use technologies to quantify, visualize and individualize mechanical ventilation, such as electrical impedance tomography and esophageal manometry. Members of our Division collaborate with several other BIDMC departments, including Interventional Pulmonology, Pulmonary, Thoracic, Critical Care and Sleep Medicine. We also work with colleagues within our department in the perioperative research group and the Regional, Vascular, Cardiovascular and Critical Care Divisions.

The following is a selection of our current research projects:

- Feasibility and validity of esophageal and transpulmonary pressure measurements during one-lung ventilation
- The association between ventilatory parameters and postoperative respiratory complications in patients undergoing general anesthesia with one-lung ventilation
- Intraoperative mechanical power and postoperative respiratory failure in patients undergoing general anesthesia
- The interaction between tidal volume and lung elastance during general anesthesia: A registry study in two hospital networks
- The effect of positive end-expiratory pressure titration on ventilation-perfusion matching during one-lung ventilation
- Titration of positive end-expiratory pressure for one-lung ventilation based on three different methods: A prospective study
- Use of endobronchial optical coherence tomography (EB-OCT) for low-risk diagnosis of interstitial lung disease
- Phase 2, single-dose, open-label, exploratory study to investigate the safety and efficacy of OTL38 injection for intraoperative imaging of folate-receptor-positive lung nodules (Dana Faber Cancer Institute)
- Grants: Maximilian Schaefer has received a Career Development Grant from the Department of Anesthesia, Critical Care & Pain Medicine

### SELECTED PUBLICATIONS

Polshin V, Petro J, Wachtendorf LJ, Hammer M, Simopoulos T, Eikermann M, Santer P. Effect of Peripheral Nerve Blocks on Postanesthesia Care Unit Length of Stay in Patients Undergoing Ambulatory Surgery: A Retrospective Cohort Study. *Reg Anesth Pain Med.* 2021. PMID: 33452202

Schaefer MS, Loring SH, Talmor D, Baedorf-Kassis EN. Comparison of Mechanical Power Estimations in Mechanically Ventilated Patients with ARDS: A Secondary Data Analysis from the EPVent Study. *Intensive Care Med.* 2021. PMID: 33078240

Chaudhary O, Baribeau Y, Urits I, Sharkey A, Rashid R, Hess P, Krumm S, Fatima H, Zhang Q, Gangadharan S, Mahmood F, Matyal R. Use of Erector Spinae Plane Block in Thoracic Surgery Leads to Rapid Recovery from Anesthesia. *Ann Thorac Surg.* 2020. PMID: 32442622

Pawlowski J, Feinstein D, Crandall ML and Gala S. Modernizing Biomedical Training: Replacing Live Animal Laboratories with Human Simulation. In: Herrmann K and Jayne K, eds., *Animal Experimentation: Working Towards a Paradigm Change*, Vol. 22. Leiden: Brill; 2019; pp. 551-66. DOI: <https://doi.org/10.1163/9789004391192>

Schaefer MS, Hammer M, Santer P, Grabitz SD, Patrocinio M, Althoff FC, Houle TT, Eikermann M, Kienbaum P. Br J Anaesth. Succinylcholine and Postoperative Pulmonary Complications: A Retrospective Cohort Study Using Registry Data from Two Hospital Networks. *Br J Anaesth.* 2020. PMID: 32654742

Shaydenfish D, Wongtangman K, Eikermann M, Schaefer MS. The Effects of Acetylcholinesterase Inhibitors on Morbidity after General Anesthesia and Surgery. *Neuropharmacology.* 2020. PMID: 32416089



### YOUNG RESEARCHER

## Riccardo Pincioli, MD



Riccardo recently joined the Anesthesia Department and the Thoracic Anesthesia Division as a clinical researcher and attending anesthesiologist. Since graduating medical school at

the University of Milan, Italy, Riccardo has done clinical and pre-clinical research in the field of mechanical ventilation and acute lung injury, with a particular focus on innovative strategies for the individualization of ventilator settings, as well as the development of novel technologies for care of high-risk and critically ill patients. Over the past decade, he conducted several clinical studies based on the understanding and application of pulmonary and cardiovascular physiology at the bedside. His collaborations include institutions both in Europe and in the United States. Mentored by Dr. Warren M. Zapol, emeritus anesthesiologist-in-chief at Massachusetts General Hospital, Riccardo studied the application of nitric oxide inhalation under different clinical conditions, including, more recently, critically ill patients with COVID-19. He has also mentored trainees as the former associate program director of the Anesthesia, Critical Care, and Pain Medicine Residency at the University of Milan-Bicocca, one of the largest and most prominent training programs in Italy. In 2018 he served as a junior editor on the board of the *Journal of Intensive Care Medicine*. Riccardo became a Harvard Medical School instructor in anaesthesia in 2019, and he has published over 30 PubMed-indexed peer-reviewed research articles as well as book chapters. Riccardo is a terrific addition to our division's research program and plans to further his already successful career as a clinician-scientist, including establishing departmental and hospital collaborations for his work.



## Education

The Thoracic Anesthesia staff participate in a variety of teaching activities on a local and national level. At BIDMC, members of the Division train residents through lectures, simulations and virtual bronchoscopy sessions as well as during day-to-day practice in the operating room. In 2019 and 2020, 52 residents completed their Thoracic Anesthesia rotation. Recently, an initiative was started to expand the education program by interactive, online-based teaching modules using Articulate 360 and the online-platform Moodle. This program will facilitate resident education in thoracic anesthesia in three steps: 1) completion of an interactive online introductory course; 2) hands-on simulator training and 3) teaching and training in the operating room. The curriculum will be supported by ongoing lectures and a journal club discussing important scientific manuscripts in the field of thoracic anesthesia.

Our division also supervises the Thoracic Anesthesia rotation of the Cardiothoracic Anesthesia Fellowship program. This rotation is currently extended by an educational “mini-attending” rotation where, under the supervision of a thoracic anesthesia attending, cardiothoracic anesthesia fellows supervise and teach residents, thereby acquiring important skills in trainee supervision and teaching that are highly relevant when becoming an attending anesthesiologist. In addition, the interventional pulmonology fellows in New England visit BIDMC for an orientation and demonstration session, which includes lectures on anesthesia and on the practice of airway-management skills taught by anesthesiologists.

Members of the Thoracic Anesthesia Division provide education and educational content outside of BIDMC on a variety of platforms—book chapters, hands-on educational sessions, as editors of international scientific journals or the highly frequented online resource UpToDate, where Dr. John Pawlowski serves as author for the sections on thoracic anesthesia and pharmacology.



## Quality Improvement

Our division has several ongoing quality improvement projects:

**Increasing the comfort with one-lung ventilation in non-thoracic anesthesia faculty.** This initiative assesses the skillset and comfort level of attendings who are not part of the Thoracic Anesthesia Group but take care of patients who require lung isolation and one-lung ventilation (e.g., during on-call hours). We are implementing training and resources to enhance skill and confidence when initiating one-lung ventilation. We will evaluate overall comfort level after participants have completed the initiative to evaluate success.

**Enhanced recovery after complex surgery.** This multidisciplinary initiative includes a variety of interventions implemented to facilitate recovery after complex cardiac, vascular and thoracic procedures. These interventions aim to reduce perioperative complications and length of stay in the post-anesthesia care unit and the hospital through identification of high-risk patients; reduce postoperative pain and opioid consumption; improve preoperative fluid status and glycemic control; and reduce ventilator-induced lung injury and improvement of postoperative pulmonary function. This project is being conducted in close collaboration with neighboring divisions and the Department of Surgery.

## Conclusion

The Thoracic Anesthesia Division provides care to patients undergoing many surgical and interventional procedures. This requires extensive skill in anesthesia techniques, airway management, ventilation, bronchoscopy, and neuraxial and peripheral regional anesthesia. The complexity of the work offers important opportunities for teaching, which is a major focus in the division, and also makes it vital that we empower all our faculty to safely conduct lung-isolation techniques. The current COVID-19 pandemic posed specific challenges to the division, but we have mastered these obstacles as a team and through close collaboration with colleagues in our department and in the Surgery Department. We would like to thank Dr. John Pawlowski, who has successfully navigated our division through many years as the long-standing director and now hands over the division directorship to Maximilian Schaefer. Dr. Schaefer aspires to provide excellent patient care and work further to prevent postoperative complications and enhance recovery in our highly vulnerable patients. He is expanding clinical research, and several initiatives are ongoing to further strengthen education and quality of care. We are proud of our close collaboration and excellent working relationship with the Surgical Department under Dr. Sidhu Gangadharan and the Interventional Pulmonology Department under Dr. Adnan Majid, as well as all neighboring Anesthesia Divisions, which is key to the ongoing success of the Thoracic Anesthesia Division.



# Transplant Anesthesia



**Jason S. Wakakuwa, MD**  
 Director, Transplant Anesthesia  
 Assistant Professor of Anaesthesia

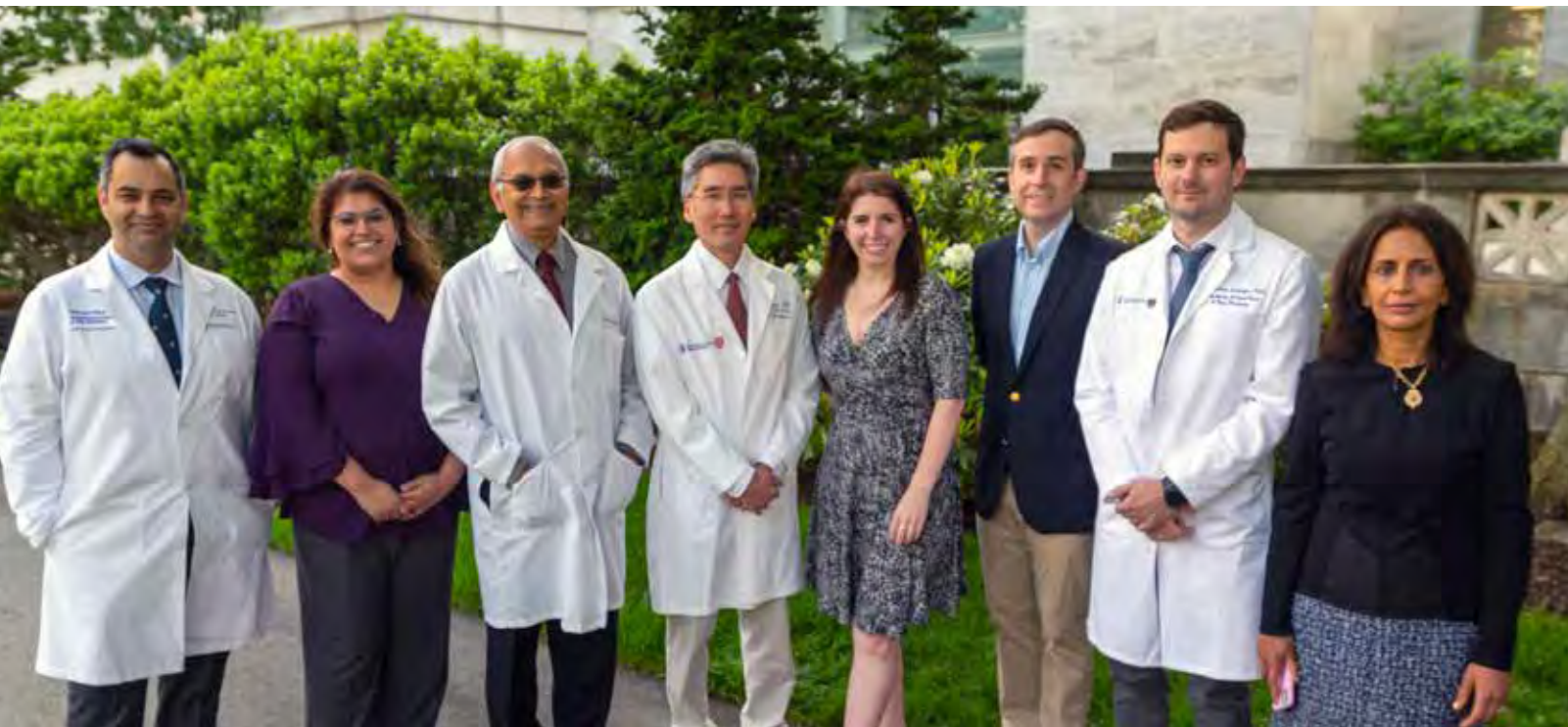
“We care for the sickest patients to give the gift of life.”

The Division of Transplant Anesthesia is comprised of 10 anesthesiologists who provide the intraoperative care of patients undergoing liver transplant surgery, as well as operations in the immediate postoperative period. The team is available 24 hours a day and also responds to care for other patients requiring the members' expertise, such as trauma patients with major inferior vena cava injuries. We also care for most patients undergoing hepatic resections and major hepatobiliary surgeries. Kidney transplants, pancreas transplants, donor nephrectomies, and dialysis access procedures are covered by members of the Department of Anesthesia as a whole.



## Clinical

Over the past several years, the Division of Transplant Anesthesia has retained a strong and stable core group of faculty. Recently, Drs. Max Schaefer, Ameeka Pannu, and Elizabeth Wilson were added to the team. In fall of 2020, Dr. Devin Eckhoff was appointed the new Chief of Transplant Surgery at BIDMC. We established a collaboration with Dr. Eckhoff that will create guidelines and protocols to optimize the care of transplant patients going forward. These initiatives include the formal use of thromboelastography (TEG) in guiding transfusion of blood products in a more judicious and effective manner. With the department's acquisition of the newer and simpler TEG 6S machines, we are able to access valuable coagulation data promptly. Also in the pipeline are protocols regarding portopulmonary hypertension, use of antifibrinolytics, and the expansion of the Live Donor Liver Transplant Program.



## Division Members

**Jessica M. Cassavaugh, MD, PhD**  
 Instructor in Anaesthesia

**John D. Mitchell, MD**  
 Vice Chair, Education  
 Director, Center for Education Research, Technology and Innovation  
 Associate Professor of Anaesthesia

**Satya Krishna Ramachandran, MD, MBBS**  
 Vice Chair, Quality, Safety and Innovation  
 Program Director, Perioperative Quality and Safety Fellowship  
 Associate Professor of Anaesthesia

**Sara E. Neves, MD**  
 Program Director, Anesthesia Residency  
 Instructor in Anaesthesia

**Ameeka Pannu, MD**  
 Program Director, Anesthesia Critical Care Fellowship  
 Instructor in Anaesthesia

**John D. Mitchell, MD**  
 Vice Chair, Education  
 Director, Center for Education Research and Innovation  
 Associate Professor of Anaesthesia

**Maximilian S. Schaefer, MD**  
 Director, Thoracic Anesthesia  
 Director of the Center for Anesthesia Research Excellence (CARE)  
 Assistant Professor in Anaesthesia

**Shahzad Shaefi, MD, MPH**  
 Vice Chair, Professional Affairs  
 Medical Director of Venovenous Extracorporeal Membrane Oxygenation (VV ECMO)  
 Associate Professor of Anaesthesia

**Eswar Sundar, MBBS**  
 Director, Clinical Operations-East Campus  
 Assistant Professor of Anaesthesia

**Sugantha Sundar, MBBS**  
 Director for Professional Affairs  
 Assistant Professor of Anaesthesia

**Elizabeth A. Wilson, MD**  
 Instructor in Anaesthesia

**John Mattimore, MD**  
 Fellow



## COVID-19

The COVID-19 pandemic had a profound impact on the volume of transplant cases performed during 2020 and resulted in much lower surgery volume during the spring and summer. There was a lack of intensive care unit (ICU) beds in the Medical Center due to the large number of COVID-positive patients on ventilators for long periods of time. Inpatient floors and portions of the Post-Anesthesia Care Unit were converted to ICUs so that even kidney transplants were not possible. There was the fear of immunosuppressing these patients at a time when the infection and death rate associated with the virus was incredibly high. In the fall, as COVID inpatient and ICU admissions decreased dramatically, transplant surgery was allowed to restart. Patients were reliably tested immediately prior to surgery, and the success rate of the performed cases was extremely high.

## Education

All of our team members are actively involved in the academic mission of the department. Many have been invited to speak at grand rounds lectures and society conferences throughout the country, and a transplant block of resident lectures is also organized on a biannual schedule. This block consists of a number of lectures pertaining to pathophysiology, intraoperative management, surgical considerations, and case presentations.

Beginning in 2017, a joint Liver Anesthesia Transplant Fellowship program was established with the Lahey Medical Center. This venture allows for the clinical fellow to participate in the care of transplant patients in two very different clinical settings and practices. At BIDMC, the fellow's role has evolved into a "Junior Attending," who helps to provide assistance with clinical decision-making, procedural support, data interpretation and intraoperative teaching. Fellows will also be able to gain experience in intraoperative transesophageal echocardiography, which will be done in conjunction with the Division of Cardiac Anesthesia.

## Conclusion

The Division of Transplant Anesthesia cares for the most severely ill of all surgical patients undergoing one of the most complex operations performed at BIDMC. The members are dedicated to providing the

Transplant Anesthesia	FY18	FY19	FY20	FY21 YTD
<b>Case Volume</b>				
Kidneys	74	96	71	70
Liver	78	70	83	104
<b>Total Cases</b>	<b>506</b>	<b>565</b>	<b>504</b>	<b>464</b>

highest level of expert care, which manifests in excellent patient outcome data. We are all privileged to work with our surgical colleagues to give these patients the gift of life.



# Vascular Anesthesia



## Robina Matyal, MBBS

Director, Vascular Anesthesia  
Leonard Bushnell Chair of Anaesthesia  
at BIDMC  
Associate Professor of Anaesthesia

The Division of Vascular Anesthesia is a dedicated team of anesthesiologists who care for a challenging patient population and bring immense experience, motivation, enthusiasm and compassion to their clinical work.

## Clinical

Our division provides services for patients undergoing open and endovascular vascular surgery. Our clinical volume of 664 cases performed in 2019 and 522 cases performed in 2020 makes the Vascular Surgery Division one of the busiest clinical services in the city. The case mix of our vascular surgery ranges from open thoraco-abdominal aortic aneurysm repair surgery and endovascular procedures to transcatheter arterial flow reversal procedures with combined open and endovascular steps under cardiac and neurophysiologic monitoring.

Endovascular procedures are performed in the “hybrid” operating rooms with the capability to support procedures under fluoroscopy or open surgical procedures. These procedures require the highest level of vigilance, monitoring and resuscitation, providing our staff and residents a unique clinical experience. Our extensive clinical experience and complex cases allow us to provide a state-of-the-art teaching environment for residents.

Vascular Anesthesia	
Case Volume	
FY18	914
FY19	810
FY20	682
FY21 Proj	709



## Division Members

Rae M. Allain, MD  
Member of the Faculty

Ruma R. Bose, MD, MBBS  
Program Director, Adult Cardiothoracic Fellowship  
Assistant Professor of Anaesthesia

Jessica M. Cassavaugh, MD, PhD  
Instructor in Anaesthesia

Philipp J. Fassbender, MD  
Assistant Professor of Anaesthesia

Kashmira S. Chawla, MD  
Instructor in Anaesthesia

J. Michael Haering, MD  
Vice Chair, Clinical Affairs  
Assistant Professor of Anaesthesia

Megan L. Krajewski, MD  
Instructor in Anaesthesia

Akiva Leibowitz, MD  
Director of ENT Anesthesia  
Assistant Professor of Anaesthesia

Feroze-Ud-Den Mahmood, MBBS  
Director, Cardiac Anesthesia  
Director, Perioperative  
Echocardiography  
Professor of Anaesthesia

Kadhiresan R. Murugappan, MD  
Instructor in Anaesthesia

Sara E. Neves, MD  
Program Director, Anesthesia  
Residency  
Instructor in Anaesthesia

Ameeka Pannu, MD  
Program Director, Anesthesia Critical  
Care Fellowship  
Instructor in Anaesthesia

Richard J. Pollard, MD  
Director Pre-Admission Testing  
Director, Quality Improvement  
Director, Neuroanesthesia Fellowship  
Assistant Professor of Anaesthesia

Deborah S. Reynolds, MD  
Site Chief, Longwood Plastics  
Assistant Professor of Anaesthesia

Mark J. Robitaille, MD  
Instructor in Anaesthesia

Lindsay A. Rubenstein, MD  
Associate Program Director,  
Anesthesia Residency  
Instructor in Anaesthesia

Maximilian S. Schaefer, MD  
Director, Thoracic Anesthesia  
Director of Center for Anesthesia  
Research Excellence (CARE)  
Assistant Professor in Anaesthesia

Sankalp Sehgal, MD  
Section Head of Anesthesia for  
Electrophysiology  
Instructor in Anaesthesia

Shahzad Shaefi, MD, MPH  
Vice Chair, Professional Affairs  
Associate Professor of Anaesthesia

Aidan M. Sharkey, MD  
Instructor in Anaesthesia

Daniel P. Walsh, MD  
Site Director for Critical Care,  
BID-Plymouth  
Associate Program Director,  
Anesthesia Residency  
Instructor in Anaesthesia

## COVID-19

Due to the COVID-19 pandemic, the vascular procedures declined from 664 cases in 2019 to 533 in 2020. The reduction was particularly significant in endovascular aortic repair (EVAR) and fenestrated endovascular aortic repair, bypass procedures, open and endovascular carotid procedures, and lower-extremity amputation.

However, an increase in thoracic endovascular aortic repair (TEVAR) cases was seen in 2020 as compared to previous years.

## Research

Multiple division members have participated in various clinical, basic science, and educational research projects. Our clinical research ranges from database analysis and use of ultrasound for cardiac and lung assessment to three-dimensional printing of patient-specific thoracic aortic aneurysms for preplanning related to various arterial branching re-anastomosis procedures. The clinical research focuses on identifying optimal anesthetic techniques in patients undergoing lower-extremity amputations through analysis of national databases and demonstrated improved outcomes with regional anesthesia. In addition, we established that preemptive use of continuous peripheral nerve block in patients undergoing lower-extremity amputation allows for enhanced recovery through reduction in pulmonary complications, sufficient pain control and decrease in opioid consumption.

Our basic science research involves nanoparticle-based remote delivery of angiogenic molecules for microvascular growth, pathophysiology of post-cardiac surgical atrial fibrillation and gender-based differences in diabetic cardiomyopathy. Currently, we are exploring the gender-based differences in heart failure and altered adenosinergic responses in the setting of postmenopausal estrogen deficiency along with the translational implications via pharmacological Adora2AR agonist. Our division members have presented our research at various annual scientific sessions at the American Society of Anesthesiologists, Society of Cardiovascular Anesthesiologists, American Heart Association, and Harvard Medical School.

## Grants and Funding

Our faculty members have received various prestigious grants and funding from organizations such as the National Institutes of Health, National Institute of General Medical Sciences and National Institute of Diabetes and Digestive and Kidney Diseases to investigate benefits of permissive hypoxia in sepsis, use of deferoxamine for the prevention of acute kidney injury and the gender-based differences observed in heart failure and altered adenosinergic responses in the setting of postmenopausal estrogen deficiency.

“The knowledge alone is not enough; application of ideas is the key to a successful outcome.”



## Education

### Teaching and Mentorship

We have developed a comprehensive curriculum for residents on vascular rotation that includes pre-learning with web-based interactive modules on common topics and simulator-based training to maximize learning from every clinical exposure with the patient. The learning starts before the vascular surgery rotation with identified knowledge and skill expectations, meeting minimum numbers, followed by self-assessment tools and problem-based scenarios. We consistently strive to maintain balance between the service and educational components of our daily operation. Members of our division are consistently rated among the best clinical teachers. Their teaching activities include bedside teaching, formal lectures and participation in national and international conferences. With more advanced and high-risk surgeries, the residents' clinical experience continues to improve.

Our perioperative ultrasound-teaching program is thriving. With multiple staff members certified in perioperative transesophageal echocardiogram (TEE) and critical care ultrasound, residents also learn various aspects of rescue TEE, cardiac monitoring and point-of-care ultrasound. For the COVID-19 effort, we introduced a pilot training program for the clinical use of the ultraportable Butterfly Ultrasound. Besides being an affordable point-of-care ultrasound product, the web-based storage of ultrasound images enables real-time expert consultation and feedback. Also, using the proprietary link, experts can provide real-time imaging guidance in probe manipulation and image optimization, obviating the need for physical presence of the instructor. Our members play a significant role in peer-support groups across the Beth Israel Lahey Health (BILH) network and have received awards for teaching excellence at Harvard Medical School. Various members of the division serve on professional national and international committees, editorial boards and educational symposia.

### Fellowship Program

Our Advanced Vascular and Ultrasound fellowship is a success and a productive experience for both the current fellow, Santiago Krumm, MD and the department. The fellow gains expertise in advanced monitoring and management devices—for example, ventricular assist devices, spinal drains, pacemakers, and hybrid operating room with stand-by pump—through participation in high risk surgeries. The key areas where our fellow contributes include creation of multiple educational tools, “standard of practice” pathways for equipment setup in TEVAR and EVAR, CSF drain placement in ruptured AAA and presentations in multidisciplinary grand rounds. Additionally, the fellow facilitates supervision of residents in invasive monitoring of arterial line, central line and perioperative ultrasound. Our upcoming fellow for year 2021-2022 is Meera D. Ramsooksingh, MD, MS.

### SELECTED PUBLICATIONS

Chaudhary O, Baribeau Y, Urits I, Sharkey A, Rashid R, Hess P, Krumm S, Fatima H, Zhang Q, Gangadharan S, Mahmood F, Matyal R. Use of Erector Spinae Plane Block in Thoracic Surgery Leads to Rapid Recovery from Anesthesia. *Ann Thorac Surg*. 2020. PMID: 32442622

De Biasio J, Mittel A, Kim D, Ferrante L, Shaefi S. Frailty in Critical Care Medicine: A Review. *Anesth Analg*. 2020 June; 130(6):1462-73 PMID: 32384336

Leibowitz A, Oren-Grinberg A, Matyal R. Ultrasound Guidance for Central Venous Access: Current Evidence and Clinical Recommendations. *J Intensive Care Med*. 2019. PMID: 31387439

Mahmood E, Bae S, Chaudhary O, Zhang Q, Feng R, Mahmood F, Rashid R, Robson S, Lee D, Kang P, Matyal R. Neuropeptide Y3-36 Incorporated Into PVAX Nanoparticle Improves Angiogenesis In a Murine Model of Myocardial Ischemia. *Eur. J. Pharmacol*. 2020. PMID 32534073

Mahmood E, Jeganathan J, Saraf M, Feng R, Khabbaz K, Mahmood F, Venkatachalam S, Liu D, Chu L, Parikh SM, Matyal R. Decreased PGC-1 $\alpha$  Post-Cardiopulmonary Bypass Leads to Impaired Oxidative Stress in Diabetic Patients. *Ann Thorac Surg*. 2019. PMID: 30291832

Mahmood E, Matyal R, Mahmood F, Xu X, Sharkey A, Chaudhary O, Karani S, Khabbaz K. Impact of Left Atrial Appendage Exclusion on Short Term Outcomes in Isolated Coronary Artery Bypass Graft Surgery. *Circulation*. 2020. PMID: 32489114

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Neves SE, Fatima H, Walsh DP, Mahmood F, Chaudhary O, Matyal R. Role of Ultrasound-Guided Evaluation of Dyspnea in the Coronavirus Disease 2019 Pandemic. *J Cardiothorac Vasc Anesth*. 2020; PMID: 32737001

Shaefi S, Shankar P, Mueller AL, O'Gara BP, Spear K, Khabbaz K, Bagchi A, Chu L, Banner-Goodspeed V, Leaf DE, Talmor DS, Marcantonio ER, Subramaniam B. Intraoperative Oxygen Concentration and Neurocognition after Cardiac Surgery: A Randomized Clinical Trial. *Anesthesiology*. 2021. PMID: 33331902

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### Major Lectures

- Perioperative Ultrasound Education and Gender Differences in Cardiovascular Disease, Groningen University Medical Center, Netherlands
- Point-of-Care Ultrasound for Evaluation of Hypotension and Dyspnea, First Peking University Hospital, Beijing, China
- Assessment of Right and Left Ventricle Function, American Society of Anesthesiologists Annual Meeting, San Francisco
- Grand Round Talk and Workshop on Perioperative Ultrasound, Department of Anesthesia, Northwestern Medical Center, Chicago
- Ultrasound-Guided Assessment of Hypotension Workshop, Department of Anesthesia, University of Virginia, Charlottesville
- Point-of-Care Ultrasound and Evaluation of Tamponade, Post Graduate Assembly in Anesthesiology, New York
- Oxygen: Too Much of a Good Thing? University of North Carolina, Chapel Hill, NC
- Bench to Bedside: Best Evidence about Risk, Mechanism and Therapy of Organ Injury for the Clinician, The Society of Cardiovascular Anesthesiologists' 41st Annual Meeting, Chicago, IL
- Vasoplegia Following Cardiac Surgery—A Brave New World, ICU Symposium, Chengdu Medical Center, China
- Perioperative Oxygen—Friend or Foe? American Society of Anesthesiologists Annual Meeting, Orlando, FL
- Oxygen, Carbon Monoxide and Everything in Between! Department of Anesthesiology, University of Colorado, Boulder, CO

### Formal Training Courses

The team members run many national and international courses for teaching perioperative ultrasound. We teach both two-dimensional and three-dimensional TEE to our residents and faculty, and for the past few years the group extended their ultrasound teaching program to surgical residents. This program is shared with multiple national and international anesthesia, cardiology and surgical training programs.

### YOUNG RESEARCHER

## Jessica Cassavaugh, MD, PhD



Dr. Jessica Cassavaugh is a stellar clinician and up-and-coming researcher whose work is making important contributions to our field. She started on the T32 research fellowship during the

fall of 2020 with Drs. Robina Matyal and Simon Robson as her mentors. Her project focuses on the effect of estrogen on ischemic myocardial injury; more specifically, investigating the roll of both hypoxic and purinergic signaling pathways on microvascular injury in endothelial cells. The overall goal is to identify molecular targets that can be developed and utilized for decreasing morbidity and mortality in heart failure.





## Quality Improvement

Division members participate in multiple ongoing quality-improvement projects throughout the year. Our collaborative projects with our vascular surgery colleagues have streamlined and simplified the preoperative work-up. The Vascular Division has created a standard of practice for the selection, ultrasound-guided placement and management of lumbar drains in high-risk vascular surgeries. This has been adopted and distributed across the BILH network and published in a vascular surgery journal. Additionally, we have created a multi-disciplinary, standardized practice approach to streamline the implementation of a ruptured abdominal aortic aneurysm rupture protocol. These clinical innovations have made the procedures smoother, decreased complication rates and improved outcomes. Another standard of practice was developed for peripheral nerve catheters to optimize analgesia in patients undergoing lower-extremity amputations, which demonstrated improved outcomes. Based on these well-established protocols and evidence-based management principles, our vascular surgery outcomes remain among the best in the country. Our current quality-improvement initiatives include continuous improvement in operating room efficiency and workflow and optimization of preoperative and intraoperative strategies to monitor and protect renal function through expert surveys and discussion sessions. We have also introduced new spinal drain equipment and two LiDCO hemodynamic monitors for noninvasive blood pressure monitoring, which are able to measure stroke volume and cardiac output as well.

## Conclusion

The Vascular Division is proud of the accomplishments of its members, who are excellent clinicians dedicated to the well-being of a challenging patient population, extraordinary teachers who are consistently rated among the best and phenomenal researchers with grants and funding from prestigious organizations. Our division continuously strives to innovate educational tools, streamline operating room workflow and improve perioperative outcomes in our patients through multiple quality-improvement initiatives.

## SELECTED PUBLICATIONS, cont'd

Shaefi S, Brenner SK, Gupta S, O'Gara BP, Krajewski M, Charytan DM, Chaudhry, Mirza S, Peev V, Anderson M, Bansal A, Hayek SS, Srivastava A, Matthews KS, Johns TS, Leonberg-Yoo A, Green A, Arunthamakun A, Wille WK, Admon AJ, Semler MW, Hernan MA, Mueller AL, Wang W, Leaf DE, for the STOP-COVID Investigators. Extracorporeal Membrane Oxygenation and Mortality Among Patients with Severe COVID-19, a STOP-COVID Study. *Intensive Care Med.* 2021. PMID: 33528595

Zhang Q, Feng R, Chaudhary O, Mahmood E, Baribeau Y, Rashid R, Khabbaz K, Chu L, Liu D, Senthilnathan V, Cassavaugh J, Mahmood F, Robson S, Matyal R. Cardiopulmonary Bypass Suppresses FOXO3a Activation and Downstream Autophagy in Diabetic Human Heart. *Ann Thorac Surg.* 2020. PMID 32712101







# Critical Care



# Critical Care



**Todd W. Sarge, MD**  
Vice Chair, Critical Care Medicine  
Assistant Professor of Anaesthesia

“I am proud of the clinical excellence, compassion and dedication of every member of our Critical Care Team.”

Critical Care	FY19	FY20	FY21 Proj
Encounters	6,738	7,431	5,788
Total Admissions	1,907	1,947	2,096
Procedures	899	1,207	1,420

\*FY21 Proj is based on actual October 2020 through March 2021 annualized.

Other Medicine includes: CPR, Cardioversion, EHCO, Doppler, etc.

The Division of Critical Care is a major division in the Anesthesia Department and provides critical care services in the following four surgical intensive care units (ICUs) at Beth Israel Deaconess Medical Center (BIDMC).

**Trauma Surgical Intensive Care Unit (TSICU)** — a 10-bed unit caring for trauma, thoracic and acute-care surgery patients admitted largely through the emergency room. Intensivist coverage of this unit is shared 50% with the Division of Surgical Critical Care.

**Surgical Intensive Care Unit (SICU)** — an eight-bed unit caring for a variety of surgical patients, including transplant, hepato-biliary, and general surgery. Attending coverage of this unit is shared 50% with the Division of Surgical Critical Care.

**Cardiovascular Intensive Care Unit (CVICU)** — a 15-bed unit caring for patients undergoing cardiac and vascular surgery. Additionally, all patients supported via extra-corporeal membrane oxygenation (ECMO) are admitted to this unit. Intensivist coverage of this unit is solely provided by the Division of Anesthesia Critical Care.

**Neurosciences Intensive Care Unit (Neurosciences ICU)** — an eight-bed unit caring for patients with neurology and neurosurgical patients. This unit is dedicated to the care of neuroscience patients. Intensivist coverage of this unit is shared 50% with the Departments of Neurology and Surgery.

All of the surgical ICUs are semi-closed, and patients are cared for by multidisciplinary critical care teams. The SICU and TSICU teams consist of an attending critical care physician, a critical care fellow and dedicated house officers from the Departments of Anesthesia, Surgery and Emergency Medicine. The CVICU team consists of an attending critical care physician, a nurse practitioner/physician assistant and an attending cardiac surgeon. The Neuroscience ICU team consists of an attending critical care physician, critical care fellow, neurology resident and nurse practitioner. Overnight and on weekends, each unit is covered by a call resident (SICU/TSICU) or nurse practitioner/physician assistant (Neurosciences ICU and CVICU). Each weeknight, a single anesthesia critical care attending provides in-house coverage of all four surgical units and is assisted by an on-call fellow.

Additionally, the Division of Critical Care provides an “ICU float” service based on the West campus. This service serves several important roles, including critical care response to cardiac arrest and peri-arrest situations outside of the ICU; triage and optimization of workflow and ICU bed allocation within the hospital; and critical care services to ICU-level patients admitted to the PACU during their perioperative course.



## Division Members

- Rae M. Allain, MD**  
Member of the Faculty
- Somnath Bose, MD, MBBS**  
Site Director for Critical Care at BID-Needham  
Assistant Professor of Anaesthesia
- Jessica M. Cassavaugh, MD, PhD**  
Instructor in Anaesthesia
- Megan L. Krajewski, MD**  
Instructor in Anaesthesia
- Akiva Leibowitz, MD**  
Director of ENT Anesthesia  
Assistant Professor of Anaesthesia
- Alan Lisbon, MD**  
Executive Vice Chair Emeritus  
Associate Professor of Anaesthesia
- Haobo Ma, MD, MS**  
Instructor in Anaesthesia
- Kadhiresan R. Murugappan, MD**  
Instructor in Anaesthesia
- Sara E. Neves, MD**  
Program Director, Anesthesia Residency  
Instructor in Anaesthesia
- Brian P. O’Gara, MD, MPH**  
Section Head, Trauma Anesthesia  
Resident Program Director, Center for Anesthesia Research Excellence (CARE)  
Assistant Professor of Anaesthesia
- Achikam Oren-Grinberg, MD, MS**  
Director of Critical Care  
Echocardiography  
Assistant Professor of Anaesthesia
- Ameeka Pannu, MD**  
Program Director, Anesthesia Critical Care Fellowship  
Instructor in Anaesthesia
- Shahla Siddiqui, MD, MSc**  
Assistant Professor of Anaesthesia
- Shahzad Shaefi, MD, MPH**  
Vice Chair, Professional Affairs  
Associate Professor of Anaesthesia
- Daniel S. Talmor, MD, MPH**  
Chair of Anesthesia, Critical Care and Pain Medicine  
Edward Lowenstein Professor of Anaesthesia
- Andrea Tsai, AM, MD**  
Member of the Faculty
- Daniel P. Walsh, MD**  
Site Director for Critical Care, BID-Plymouth  
Associate Program Director, Anesthesia Residency  
Instructor in Anaesthesia

The division is actively involved in the ICU coverage of our affiliate hospitals in the network. Since October 2012, the division has provided coverage and medical directorship for the critical care unit at BID-Plymouth. Since February 2016, the division has provided coverage for the critical care unit at BID-Milton. It also assumed medical directorship of the Milton ICU in 2021. Since November 2020, the division has provided coverage and medical directorship for the critical care unit at BID-Needham. All three hospitals contain mixed medical-surgical ICUs and care for the wide variety of intensive care patients seen at a community hospital via different staffing models. The ICU in Plymouth is a closed unit staffed 24/7 by an intensivist and a team of advanced practice providers. Dr. Dan Walsh serves as the medical director for the Plymouth ICU. The ICU in Milton is a closed unit that is covered 24/7 by an intensivist with overnight help from the hospitalist service at Milton. Dr. Samir Patel was recently appointed as medical director of the Milton ICU.

## COVID-19

The division met one of its greatest challenges head on in dealing with the COVID-19 pandemic, providing critical care services at BIDMC and throughout the network during this challenging time. Beginning in March of 2020, the first critically ill COVID-19 patients began to arrive. In the first surge between March and May of 2020, COVID-19 patients were segregated into COVID-19-specific units, and anesthesia and surgical intensive care members were integral in this effort. Specifically, the SICU, CVICU and two PACU areas (West PACU and Shapiro PACU) were designated as COVID-19 ICUs and covered by critical care teams made up of anesthesia and surgery residents as well as CRNAs and advanced practice providers (APPs) from various departments, including the Anesthesia Department.







COVID Surge Space in East Shapiro demonstrating use of the anesthesia machines for ventilating COVID patients during the first surge in spring 2020.

The Anesthesia Critical Care Division was represented on the Hospital Incident Command Center and was able to ensure enough ventilators were in service at all times by adapting quickly to equip and utilize anesthesia machines and government-supplied transport ventilators in the PACU spaces. This work was supported by the Department of Anesthesia at all levels, and specifically by the brave anesthesia techs who worked tirelessly to ensure the success and operation of the anesthesia machines in these locations. When the second surge began in November 2020, we were prepared with updated protocols and new knowledge, but hospital staffing and other logistical challenges continued, including a significant respiratory care staffing shortage. Once again, the Department of Anesthesia offered vital help to this effort, with a number of our CRNAs volunteering for respiratory therapist shifts with rapid training on the ICU ventilators. Their work was truly lifesaving during the period of the pandemic.

COVID Surge Space in West PACU showing Dr. Brian O’Gara becoming familiarized with the LTV ventilators supplied to us from the government stockpile during the first COVID surge in spring 2020.



## BIDMC Anesthesiologists instrumental in success of “Boston Hope” COVID-19 field hospital

Boston and surrounding areas were hit hard by the COVID-19 pandemic. During the first surge in spring 2020, hospitals were full, and there was an urgent need to create space for patients who required monitoring but were not ill enough to be hospitalized. Enter “Boston Hope,” the 1,000-bed field hospital at the Boston Convention and Exposition Center that housed these non-critical patients in order to ease pressure on hospitals. BIDMC anesthesiologists Dr. Akiva Leibowitz and Dr. Nadav Levy provided crucial leadership to this effort, setting up and leading the Boston Hope acute-care unit for patients experiencing respiratory difficulties during their recovery.

This remarkably complex feat was completed in a short period of time. They recruited clinicians, divided the area into two units for patients with different levels of illness, and outfitted the units with oxygen, medication, and equipment, including ventilators if needed. As a result of their expert preparation, they were fully prepared to stabilize patients, manage airways, provide advanced cardiovascular life support and do respiratory and vent management as well as aerosolizing procedures



in negative-pressure rooms. Each patient was evaluated to determine whether they needed to be sent to the hospital or could be treated on site.

But caring for patients was only a part of what they accomplished during this crisis. Our Quality and Safety Initiatives (QSI) team developed a rapid response capability at Boston Hope using standard quality initiative techniques, such as process-mapping and on-site simulation, to detect hazards and obstacles and devise improvement strategies while caring for patients. There were “debriefing” discussions after emergency cases to identify barriers and improve safety and efficiency. The team created over 30 improvement strategies using these methods, and all this was accomplished under time and resource constraints and in a new environment.

This stellar QI work, which creates a model for acute-care services in field hospital settings, was detailed in a November 2020 article in *Anesthesiology*:

Levy n, Suzzo L, Erlichman RJ, Hirschberg RE, Hutton Johnson S, Yaffe MB, Ramachandran SK, Bose S, Leibowitz A. *Anesthesiology*. 2020;Nov 1;133(5):985-996.

The Medical Center and entire Beth Israel Lahey Health System rose to meet the challenges of the COVID-19 pandemic in a heroic fashion. It was true team effort that included collaboration with the medical ICUs and the hard work and skill of the entire BIDMC Staff. Together we learned, prepared, adapted, and saved many lives. The hospital has cared for a large share of the critically ill COVID patients in the Boston area and reported a low mortality rate for these patients relative to other hospitals in the area.

Additional clinical services provided by the division include:

- Airway management and support for all ICUs and the hospital at large
- Code coverage of the west campus
- Anesthesia for tracheostomies in all ICUs
- Anesthesia coverage of elective cardioversions
- Focused echocardiography support for in-hospital cardiac arrests using handheld echo devices
- Coverage of the West Campus Post-Anesthesia Care Unit

## Education

Teaching in the Division of Critical Care takes place at all levels of training, including medical students, residents and fellows. Teaching is accomplished through daily teaching rounds as well as a robust didactic program. In addition to resident rotations, the Anesthesia Critical Care Division hosts approximately 24 medical students per year from Harvard Medical School (HMS) for an HMS elective entitled Respiratory-Surgical Intensive Care. During this elective, students gain exposure to daily management of critically ill patients in a surgical critical care setting in a Level 1 Trauma Center. They participate in daily teaching rounds, procedures and resident lectures with the goals of learning basic management principles in hemodynamic and neurological monitoring and manipulation, respiratory failure and mechanical ventilation, and renal and endocrine pathophysiology, as well as with broader topics including ethics and end-of-life care.

## Basic Course

In 2011, the division began teaching the Basic Course to residents prior to their first ICU rotation. This course was designed to teach the principles of caring for the critically ill patient prior to the residents arriving in the unit. The course has been extremely successful and has since expanded to include nurse practitioners and residents from Surgery, Medicine, Neurology, Interventional Radiology and Emergency Medicine, and includes didactics, skills and simulation-based teaching. Currently, this course is run four to five times per year by critical care faculty from Anesthesia and Emergency Medicine.



## Anesthesia Critical Care Fellowship

The centerpiece of the teaching program is the Anesthesia Critical Care Fellowship, a council for Graduate Medical Education-accredited program active since 1990. To date, 75 fellows have successfully graduated from the program. The Anesthesia Critical Care Fellowship is a 12-month training program (one academic year) that consists of nine months of rotations in the ICUs and three months of electives/research time. The fellowship is directed by Dr. Ameeka Pannu and currently accepts four fellows per year into the program through the San Francisco match system. We have continued to expand our two-year fellowship opportunities, recruiting fellows for both our emergency medicine critical care and dual cardiac anesthesia/critical care pathways. The goals of the fellowship are to ensure that by the completion of their training, the fellows will be able to provide complete care for critically ill patients, lead a multidisciplinary critical care team, have a working knowledge of the administration and management of a critical care unit, be able to critically appraise the literature as it pertains to critical care medicine and have a basic understanding of the principles of research in critical care medicine. A particular strength of the fellowship is training in bedside ultrasonography and echocardiography, which leaves the division well positioned to continue to receive the very best candidates. Recently, our fellowship program received a commendation from the ACGME in March 2020 for demonstrating substantial compliance with their requirements.

In June of 2017, a new fellowship in Neuro-Critical Care was approved by the United Council for Neurologic Subspecialties and is co-directed by Dr. Shahzad Shaefi in the Department of Anesthesia and Dr. Corey Fehnel in the Department of Neurology. Neuro-Critical Care fellows can be accepted from Anesthesia or Neurology training backgrounds and spend one or two years dedicated to managing these very specialized critical care patients. Since the start of the fellowship, two fellows have matriculated and graduated from the fellowship, with a third fellow arriving in July 2021.

In 2018, the American Board of Anesthesiology approved our fellowship for a training pathway for physicians who have completed an Emergency Medicine residency to enter an ABA-approved emergency medicine pathway for board certification in critical care medicine involving a 24-month period of critical care fellowship training. Our first Emergency Medicine trainee will graduate from this new pathway in July 2021, and the second a year later in 2022.



► Airway skill teaching in simulation center by Dr. Ameeka Pannu.

◀ Dr. Dan Walsh teaching Pre-COVID Echo course.

## Young Investigators

### Somnath Bose, MD, MBBS



Dr. Bose's primary research interest is in improving long-term outcomes following

critical illness. While the clear goal is for patient survival during the ICU stay, this is not sufficient, and there also needs to be a focus on quality of life after discharge. Quality of life after survival depends on many factors, including processes of post-hospitalization care. A current project, "APICS-COVID," is an extension of earlier work, APICS-01 (NCT03738774), funded through the U.S. Department of Defense. In this multi-center project with collaborators Sam Brown, MD, MS, and Dale Needham, MD, PhD, Dr. Bose evaluates the impact of early unmet discharge needs on subsequent clinical outcomes, now with a focus on COVID-19 survivors.

### Shahla Siddiqui, MD, MSc



Dr. Siddiqui has a special interest in humanities and medical ethics as well as a passion for

medical education. She is an ardent supporter of women's academic and professional movements and is a very active member of the American Society of Anesthesia (ASA) Critical Care Medicine and Ethics committees as well as the ASA COVID-19 Council. Her focus is on qualitative methodology and ethical reviews. Dr. Siddiqui is currently conducting a study funded by a BIDMC Healthcare Delivery Sciences Innovation Grant, "Forging Interprofessional Education in the Perioperative Setting in the Time of COVID 19." This novel project brings anesthesia and surgery residents and nursing staff of the preoperative area together to discuss real life case vignettes themed around important topics that can arise during integrated teamwork with a focus on team coaching and understanding different perspectives using emotional intelligence tools. These sessions have helped bridge gaps in communication between professions and helped improve interpersonal relationships. In addition, Dr. Siddiqui has received a John Hedley-Whyte Faculty Development grant for her project, "Compassionate Care in the ICU."



## Critical Care Echocardiography and Ultrasound

Members of the division, and in particular Dr. Achikam Oren-Grinberg, are very active in the field of education in critical care echocardiography and ultrasound. The division members founded the highly successful Fundamentals of Critical Care Ultrasound course at the Society of Critical Care Medicine and have been active internationally with the World Interactive Network Focused on Critical Ultrasound organization. Locally, division members continue to teach the Harvard CME course "Ultrasonography for Intensivists and Emergency Medicine Clinicians," which sold out for 10 years in a row between 2009 and 2019 prior to a forced cancellation in 2020 due to COVID. In 2019, the National Board of Echocardiography held a new Examination of Special Competence in Critical Care Echocardiography that has been successfully passed by a number of staff and fellows.

## Post Graduate Education for Faculty

A number of staff in the Anesthesia Critical Care Division have completed the Program in Clinical Effectiveness course offered at the Harvard School of Public Health. This course is a summer program providing clinical investigators with fundamental training in Clinical Epidemiology and Biostatistics, and junior staff gain the quantitative and analytic skills needed for clinical research. Recently, Drs. Shahzad Shaefi, Somnath Bose, and Brian O'Gara completed the Program in Clinical Effectiveness, and several have continued their education to complete their master's degrees in public health.

## Leadership, Innovation and Faculty Hour Involvement

Over the past two years, the division has been involved in numerous faculty hour and quality-improvement projects, including postoperative reintubation, critical care APP training, ultrasound education and ICU volume and throughput initiatives. Dr. Ameeka Pannu works with the hospital code committee to reduce crowd and noise distractions at in-hospital codes. Dr. Todd Sarge has been



collaborating with the Medicine Department on a project to reduce preventable cardiac arrests in the ICU. Dr. Shahla Siddiqui led a program to address staff wellness and stress during COVID. Dr. Akiva Leibowitz is beginning a project to address the value of critical services for the surgical ICUs across the hospital.

Our faculty are also actively involved in hospital leadership roles. Dr. Todd Sarge is chair of the Critical Care Executive Committee and oversees all matters regarding the provision of intensive care across the medical center. Dr. Shahzad Shaefi is also a standing member of this committee. This committee reports directly to the Medical Executive Committee. Dr. Shahzad Shaefi was recently appointed the director of the veno-venous (V-V) ECMO service—a growing service within the hospital and network due to the COVID-19 pandemic. Dr. Michael Cocchi is the co-chair of the Quality Improvement Oversight Committee, a newly formed committee to assess and seek improvement for quality and safety in the hospital. Dr. Shahzad Shaefi is also a standing member on this committee. Additionally, Dr. Michael Cocchi is the chair of the Code Committee that ensures the hospital is meeting important quality metrics reportable to the American Hospital Association around in-hospital cardiac arrest. Drs. Todd Sarge and Ameeka Pannu are standing members of this committee.

## Research

The critical care division is active and productive in many areas of research. Currently, members of the division receive funding from the National Institutes of Health (NIH), the Department of Defense and various other philanthropic and industry sources. The ICU Division is part of the NIH funded PETAL Network, a large, multicenter collaborative examining interventions for patients at risk for acute respiratory distress syndrome (ARDS). Additionally, a large project program grant from the Department of Defense is currently underway examining the innate immune response in the setting of trauma.

The following are a sample of ongoing research projects and interests of the division members:

- Dr. Daniel Talmor's fields of research include intensive care outcomes, echocardiography in the ICU and the optimal delivery of mechanical ventilation.
- Dr. Matthias Eikermann has an extensive research background focusing on the improvement of postoperative patient outcomes, such as postoperative respiratory complications and appropriate use and dosing of neuromuscular blockade to enhance early mobilization for critically ill patients. Drs. Matthias Eikermann, Shahzad Shaefi and Todd Sarge are conducting a multi-centered trial on the effectiveness of midodrine for weaning critically ill patients from intravenous vasopressors and expediting discharge from the ICU.
- Dr. Somnath Bose participates in several multi-centered research studies, including

the assessment of post-intensive care syndrome (PICS) after acute lung injury and echocardiographic effects of fluids and vasopressors in sepsis.

- Drs. Achikam Oren-Grinberg, Akiva Leibowitz and Todd Sarge perform studies of echocardiography in critically ill patients during cardiac arrest.
- Drs. Michael Cocchi and Todd Sarge study cardiac arrest in the ICUs and are collaborating on a research program to identify risk factors for cardiac arrest in the ICU setting.
- Dr. Shahzad Shaefi is involved in research to evaluate the effects of hyperoxia on patients undergoing cardiopulmonary bypass as well as studying the connection between innate immune system failure and pneumonia following trauma.
- Dr. Brian O'Gara's research interests include prevention of postoperative decline and delirium; use of innovative technology and virtual reality as an adjunct to anesthesia; and the use of inhaled anesthetics to prevent lung injury and VV-ECMO.
- Dr. Shahla Siddiqui's research interests include end-of-life care, staff wellness and unconscious bias in medicine.
- Dr. Khadir Murugappan's research interests include predicting functional outcomes following surgery, and his current work focuses on implementation of risk-prediction instruments in the preoperative setting to optimize care.

The division has been extremely successful at obtaining research funding.

Currently, the division research efforts operate under the following grants:

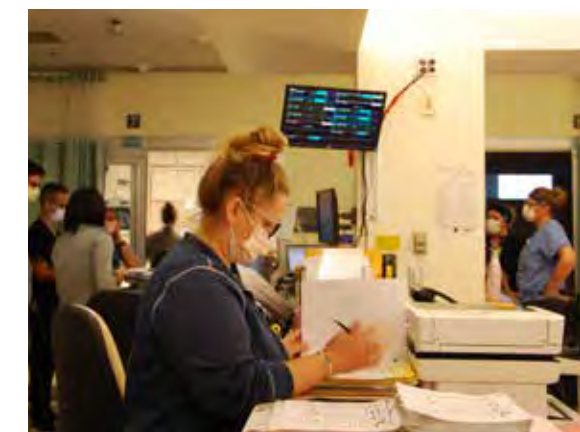
- Prevention and Early Treatment of Acute Lung Injury (PETAL Network; U01 NIH/NHLBI)—Dr. Daniel Talmor and Valerie Banner-Goodspeed, MPH
- ORCHID: Outcomes Related to COVID-19 Treated with Hydroxychloroquine Among Inpatients with Symptomatic Disease
- BLUE CORAL: Biology and Longitudinal Epidemiology of PETAL; COVID-19 Observational Study
- RED CORAL: PETAL Repository of Electronic Data; COVID-19 Observational Study
- TICO/ACTIV-3: A Multicenter, Adaptive, Randomized, Blinded Controlled Trial of the Safety and Efficacy of Investigational Therapeutics for Hospitalized Patients with COVID-19
- CLOVERS: Crystalloid Liberal or Vasopressors Early Resuscitation in Sepsis
- EASiVENT: Prospective, Multicenter, Randomized, Controlled Study Comparing Efficacy and Safety of INTELLiVENT-ASV versus Non-Automated Ventilation in Adult ICU Subjects (Hamilton Medical)—Dr. Talmor, Valerie Banner-Goodspeed, MPH
- Addressing Post Intensive Care Syndrome Among Survivors of Acute Lung Injury (APICS-01; Department of Defense)—Dr. Somnath Bose, Valerie Banner-Goodspeed, MPH

- NOSARS: Inhaled Nitric Oxide Gas Therapy in Mechanically Ventilated Patients with Severe Acute Respiratory Syndrome in COVID-19—Dr. Somnath Bose
- DAMP-Mediated Innate Immune Failure and Pneumonia after Trauma: A five-year Program Project Grant to provide greater understanding of the cellular and molecular innate immune mechanisms predisposing to pneumonia and lung injury in the traumatic patient population (Department of Defense)—Drs. Talmor and Shaefi, and Valerie Banner-Goodspeed, MPH
- STARS: Fibrinolytic Therapy to Treat ARDS in the Setting of COVID-19 Infection: A Phase 2a Clinical Trial (Genentech)—Drs. Talmor, Shaefi, and Valerie Banner-Goodspeed, MPH
- Compassionate Use of Tissue Plasminogen Activator (tPA) for Treatment of COVID-19 Associated Respiratory Failure—Drs. Talmor, Shaefi, and Valerie Banner-Goodspeed, MPH
- VIRUS: Viral Infection and Respiratory illness Universal Study; COVID-19 Registry and Validation of C2D2 (Critical Care Data Dictionary, Society for Critical Care Medicine)—Valerie Banner-Goodspeed, MPH, Dr. Bose
- WEAN SAFE: Worldwide Assessment of Separation of Patients from Ventilatory Assistance (European Society of Intensive Care Medicine)—Valerie Banner-Goodspeed, MPH
- Proteomic Analysis of Postoperative Delirium from a Randomized Trial in Older Patients Undergoing

Cardiac Surgery Exposed to Intraoperative Normoxia Versus Hyperoxia: A Nested Case-Control Study (R03-NIH/NIA)—Dr. Shaefi

- Sepsis and the Benefits of Permissive Hypoxia (K08-NIH/NIGMS)—Dr. Shaefi
- Deferoxamine for the Prevention of Acute Kidney Injury (R01-NIH/NIDDK)—Dr. Shaefi
- Scheduled Prophylactic 6-hourly IV Acetaminophen to Prevent Postoperative Delirium in Older Cardiac Surgical Patients (R01-NIH/NIA)—Dr. O'Gara
- Perioperative Virtual Reality to Reduce Sedative and Opioid Requirements (Israeli-US Binational Industrial Research Development Foundation)—Dr. O'Gara

None of the division's research efforts would be possible without the incredible efforts of our research team at the Center for Anesthesia Research Excellence, led since April 2021 by Dr. Max Schaefer (and formerly led by Dr. Bala Subramaniam) and Valerie Banner-Goodspeed, MPH.







Christine Aspin, MD  
Pain Management

**Pain Medicine**



# Arnold - Warfield Pain Center



**Thomas T. Simopoulos, MD, MA**  
 Director, Pain Medicine  
 Co-Director, Spine Clinic  
 Associate Professor of Anaesthesia

The William Arnold - Carol A. Warfield Pain Center (AWPC) offers compassionate, comprehensive and state-of-the-art care for patients with chronic and complex pain. We provide a full range of modalities to address our patients' pain and return them to a fuller, more active life. Each patient is fully evaluated by a physician team, which orders tests and treatments appropriate to that patient's specific pain issues and monitors the effectiveness of the treatment. Many of our patients have seen multiple specialists before they reach our clinic but have not experienced significant pain relief. Under our care, they receive the most advanced and sophisticated treatments as well as an understanding of the difficulties that living with chronic pain has caused in their lives. Our clinical staff includes a pain psychologist, anesthesiologists, neurologists, a physiatrist, a nurse practitioner, and a full-time team of nurses. In addition, we work closely with primary care physicians to ensure that we address their concerns about their patients, including opioid consultations.

In order to ensure thoroughness and quality, we coordinate care amongst radiology, physical therapy and surgical teams. We also treat patients with multiple co-morbidities, including cancer pain, osteoporosis, abdominal and pelvic disease and many other medical conditions. As Beth Israel Deaconess Medical Center (BIDMC) has expanded into the community, our physician staff has continued to expand, and we have added several new specialists to the team. In conjunction with BIDMC's spine surgery group, and as a stand-alone specialty practice, we now see patients at all BIDMC locations in the greater Boston area, including the Chestnut Hill Square facility, Chelsea, BID-Milton, and BID-Needham. Together, our providers seek to offer every patient cutting-edge care tailored to their individual needs.

## Comprehensive Headache Center

The Comprehensive Headache Center, directed by Dr. Sait Ashina, offers evaluation and treatment for all types of headaches, including chronic migraines and cluster headaches. Headache Center physicians are neurologists who are board-certified headache specialists. The Center offers both traditional and integrated treatment options, such as Botox injections and medication management. Clinicians work with each patient to develop a treatment plan tailored to individual needs and then monitor the plan to ensure that it is effective. The Headache Center works closely with physicians at the AWPC to make a wide range of treatment options available to our patients regardless of the etiology of their pain.



### Division Members

- Viet L. Cai, MD**  
Instructor in Anaesthesia
- Jatinder S. Gill, MBBS, MD**  
Associate Professor of Anaesthesia
- Jyotsna V. Nagda, MD**  
Director of QA/QI, Pain Medicine  
Assistant Professor of Anaesthesia
- Anthony C. Lee, MD**  
Instructor in Anaesthesia
- Paragi H. Rana, MD**  
Program Director, Pain Medicine  
Fellowship  
Instructor in Anaesthesia
- Emily L. Wang, MD**  
Instructor in Anaesthesia
- Christopher Wenger, MD**
- Cyrus A. Yazdi, MD**  
Instructor in Anaesthesia

### Headache Center Physicians

- Sait Ashina, MD**  
Director, Comprehensive  
Headache Center  
Assistant Professor of Anaesthesia  
Assistant Professor of Neurology
- Yadira Flores Montanez, MD**  
Instructor in Anaesthesia

### Nurse Practitioner

- Katrina Robertson, NP**  
BID-Needham Pain Clinic

### Psychology

- R. Joshua Wootton, MDiv, PhD**  
Director, Pain Psychology  
Assistant Professor of Anaesthesia

### Nursing

- Elizabeth Carvelli, RN, DNP**  
Nursing Director
- Katherine P. Boyle, RN**
- Joanne Cullen, RN**
- Susan B. Dwyer, RN**
- Marian A. George, RN**
- Patricia A. Smith, RN**

Arnold - Warfield Pain Center	FY19	FY20	FY21 Proj
<b>Pain Medicine</b>			
<b>Outpatient Case Volume</b>			
New Office Visits	4,348	3,344	2,738
Follow-Up Office Visits	12,912	8,273	4,394
Telehealth	0	874	882
Procedures (Does not include Post-Op pain.)	9,534	10,016	12,338
<b>Inpatient Case Volume</b>			
Consults	4,542	5,127	3,539
Daily Management	4,052	3,980	3,137
Telehealth	0	0	0
Procedures	26,350	23,037	21,675

<b>Pain Procedures</b>			
Blood Patches	26	17	15
Cervical	670	735	808
Discographies	2	0	0
Kyphoplasties	28	14	9
Lumbar	3,462	3,693	3,662
Other Procedures	3,444	3,166	4,442
Permanent Placement of SCS*	148	46	51
Radiofrequencies	709	1,153	1,306
<b>Total</b>	<b>8,500</b>	<b>8,828</b>	<b>10,294</b>

FY21 Proj is based on actual October 2020 through March 2021 annualized.



In addition to clinical treatment, the Center is committed to educating trainees about headache medicine. All AWPC Pain Fellows are instructed by Headache Center neurologists both in lectures and in hands-on evaluation and treatment sessions. This valuable component of the Pain Fellowship introduces trainees to the intricacies of headache treatment and gives them opportunities to hone their skills over the fellowship year.

## COVID-19

When the COVID-19 pandemic struck in early 2020, we rapidly adjusted our clinical practice to continue to serve our Pain Center patients. COVID-19 presented unique challenges to our clinicians in terms of both diagnosis and management of patients. The first wave initially reduced total clinic activity by 80%. With the help of administrative support and management, clinicians quickly transitioned to telehealth visits in order to continue care. This transition was rapid and successful, and clinicians became increasingly proficient at conducting these types of visits to provide the best care. There were significant challenges presented by online visits. Prescribing pain medication, particularly controlled substances, can be difficult to monitor when integrated into telehealth. We did continue with live visits in some of the more difficult cases, maintaining screening protocols for COVID-19 and social distancing measures, and rearranging our physical space to accommodate safe practice measures. There were also uncertainties about the safety and use of nerve blocks with corticosteroids that evolved rapidly by summer of 2020. When vaccines arrived, we were faced with the additional challenge of developing guidelines for when to administer pain treatment during the vaccination period. Despite the obstacles, we have continued to provide superb and seamless care to our patients. During 2020, weekly case visits ranged from 650-700. Between 110 to 130 of those visits were for procedures, and 36% were conducted via telehealth consultation.

## Research

Moving the field of pain medicine forward through research continues to be a central tenet of our mission as an academic center. Pain Division faculty design and implement a variety of research projects each year using intramural and extramural grants.

Currently these are the active protocols in the clinic:

- Complications of Spinal Cord Stimulations  
Faculty: Thomas Simopoulos, MD
- RELIEF: A Global Registry to Evaluate Long-Term Effectiveness of Neurostimulation Therapy for Pain  
Faculty: Jatinder S. Gill, MD
- Survey of Practice Parameters of Physicians Implanting Spinal Cord Stimulators  
Faculty: Jatinder S. Gill, MD
- Follow-Up Study to Evaluate the Long-Term Safety of Clonidine Micropellets for the Treatment of Pain Associated with Lumbrosacral Radiculopathy in Adults: RePRIEVE  
Faculty: Jatinder S. Gill, MD



### Arnold - Warfield Pain Center Administrative Staff

Juanita Brown  
Practice Manager

### Administrative Assistants

Colleen Michaels-Walsh  
Ashley McCarter  
Christina Nkrumah-Appiah,  
BID-Milton Pain Clinic  
Sandra Avendano,  
BID-Needham Pain Clinic

### Revenue Cycle Team

Vittaya Jaraskul  
Rev Cycle Supervisor  
Sandy Barbosa  
Managed Care Coordinator  
Aduapemi Benson  
Managed Care Coordinator  
Earlena Williams  
Out-Patient Pain Specialist

### Clinical Practice Assistants

Cynthia Columbus  
Wesnaica Jean Pierre  
Katelyn Steeves  
Anita Wood

### Patient Services Representatives

Claudia O. Beauvais  
Heather Lane

### Practice Representatives

Wanda Hunt  
Jo-Ann Martell  
Franchesca Ortiz

### Practice Coordinator

Melissa Egan

- A Discarded Tissue Study to Characterize the Effects of Laser on Spine Tissue  
Faculty: Jatinder S. Gill, MD
- The Utility of Thoracolumbar Injury Classification and Severity (TLICS) Score of the Management of Vertebral Compression Fractures; Prognostication of Outcomes  
Faculty: Jatinder S. Gill, MD
- A Pilot Study to Develop Radio-Anatomic Landmark for the Posterior Lumbar Epidural Space  
Faculty: Jatinder S. Gill, MD
- Pilot Study to Develop Radio-Anatomic Landmark for the Posterior Cervical and Cervico-Thoracic Epidural Space  
Faculty: Jatinder S. Gill, MD
- Boston Scientific Relief Study – Industry Grant for Outcomes in Spinal Cord Stimulation (BIDMC participating site)  
Faculty: Jatinder S. Gill, MD

## Education

Our Pain Fellowship Program is considered one of the top pain fellowships in the country. This year, we had 220 applicants for our seven fellowship slots.

Both fellows and the anesthesiology residents who rotate through the Pain Center each month participate in outpatient evaluation and treatment in the clinic and see patients for acute and chronic pain management during inpatient rounds. In addition, residents and fellows participate in didactic rounds several times each week, undergo training in fluoroscopic-guided procedures, and hone their skills taking patient histories and conducting general physical, neurological and musculoskeletal examinations. Fellows also see patients in our Comprehensive Headache Center (which is part of the Division of Pain Medicine), participate with our pain psychologist in initial pain psychology evaluations, and gain exposure to the evaluation and treatment of pediatric pain at Boston Children's Hospital. A variety of affiliated faculty in the areas of pain psychology, neurology, spine surgery, and physiatry also teach our fellows multidisciplinary and multimodal approaches to pain treatment. The overall goal is to teach the fellows the entire spectrum of pain management, from pharmacologic options to interventional procedures as well as alternative and complementary approaches.

In addition to our own physician group, all of whom have appointments at Harvard Medical School, a variety of guest lecturers from different specialties and backgrounds are brought in to foster a multidisciplinary approach to pain medicine. Pain Fellows also participate in departmental grand rounds, special seminars and clinical case conferences. Throughout the year, a comprehensive list of pain medicine topics are covered to fulfill the current Accreditation Council for Graduate Medical Education curriculum requirements.





### Current treatment modalities included in training:

- Injection therapies and nerve blocks – lumbar, thoracic and cervical epidural steroid injections, sympathetic blocks, selective nerve root blocks
- Nerve ablation therapies – radiofrequency and cryoanalgesia, implantable spinal cord stimulators, peripheral nerve stimulators and intrathecal drug delivery systems
- Minimally invasive lumbar decompression (MILD)
- Kyphoplasty
- Psychological counseling and cognitive behavioral strategies

The COVID-19 pandemic has generated some changes in our training methods, particularly the development of a virtual education program that includes primary core lectures, problem-based learning discussions and key literature sources.

### Quality Assurance

Our Pain Center conducts ongoing quality assurance efforts to ensure that our care and training continue to meet the highest standards and are based on the most current evidence in the field. During the past several years, we developed screening protocols and treatment pathways for pain procedures during the COVID-19 pandemic. Our faculty also serve on key committees at BIDMC that relate to clinical and ethical issues in pain medicine, including the Opioid Care Committee and the Perioperative Substance Abuse Committee. In addition, faculty participate in the annual GME Pain Fellowship Program Committee and the Harvard Medical School Clinical Skill Coaching Faculty.

### Conclusion

The AWPC is a friendly, collegial environment to practice pain medicine that is grounded in clinical and scientific excellence. We are at the forefront of pain medicine research and have one of the top pain medicine fellowships in the country, promoting consistent intellectual challenge and a passion for pain medicine in our clinicians. Our motto is that we must always do what is best for the patients. We are proud that we were able live up to that principle and remain open during the COVID-19 pandemic in order to provide care and relief to the many patients who rely on us for help.

### Major Lectures:

- Dr. Nagda (2/8/20): Evaluation and Management of Chronic Abdominal Visceral Pain. 35th Annual National Conference of Indian Society for the Study of Pain (ISSPCON 2020), Ahmedabad, India. Organized by the Indian chapter of the International Association for the Study of Pain.
- Dr. Nagda (1/6/20): Chronic Pelvic Pain. National Pelvic Pain Symposium. Rede D’Or Sao Luiz, Rio de Janeiro, Brazil.
- Dr. Simopoulos (8/19/20): High-Frequency Spinal Cord Stimulation Following Failed Spinal Cord Stimulation. International Neuromodulation Society Annual Meeting.

### SELECTED PUBLICATIONS

Gill JS, Breeze JL, Simopoulos TT. Pain Management Best Practices from Multispecialty Organizations During the COVID-19 Pandemic and Public Health Crises-Evaluating the Risk of Infection Associated with Corticosteroid Injections. *Pain Med.* 2020. PMID: 32500153

Orhurhu V, Agudile E, Chu R, Urits I, Orhurhu MS, Viswanath O, Ohuabunwa E, Simopoulos T, Hirsch J, Gill J. Socioeconomic Disparities in the Utilization of Spine Augmentation for Patients with Osteoporotic Fractures: An Analysis of a National Inpatient Sample from 2011 to 2015. *Spine J.* 2020. PMID: 31740396

Simopoulos T, Sharma S, Wootton RJ, Orhurhu V, Aner M, Gill JS. Discontinuation of Chronic Opiate Therapy After Successful Spinal Cord Stimulation Is Highly Dependent Upon the Daily Opioid Dose. *Pain Pract.* 2019. PMID: 31199551







**Education**



# Education



**John D. Mitchell, MD**

Vice Chair, Education

Director, Center for Education Research, Technology and Innovation

Associate Professor of Anaesthesia



**Sara E. Neves, MD**

Program Director, Anesthesia Residency

Instructor in Anaesthesia

Our educational mission is to develop leaders in our profession through excellent clinical experience, strong mentorship, innovative teaching curricula and a flexible program of unique offerings that can be adapted to meet each learner's needs. This is accomplished via a relentless pursuit of excellence through continuous quality improvement and creativity grounded in sound educational theory and evidence. In recognition of our success, our core residency program, and our cardiac, pain management, obstetric, and critical care fellowships all hold the maximum 10-year cycle under the Accreditation Council for Graduate Medical Education's (ACGME) Next Accreditation System.

There have been several leadership transitions in our division over the past several years. Dr. John Mitchell left his long-time position as program director of the anesthesia residency to become director of the Center for Education Research, Technology and Innovation (CERTAIN). Dr. Sara Neves took over as program director of the residency. Most recently, Dr. Mitchell was named the vice chair of education, following Dr. Stephanie Jones, who was selected to be chair of the Department of Anesthesia at Albany Medical Center.

Our new associate program directors each bring individual strengths to their positions. Dr. Lauren Buhl has updated and improved resident case assignments and rotations. Dr. Lindsay Rubenstein has implemented our popular Faculty Advisor Program and is our social media ambassador, and Dr. Daniel Walsh has created an innovative curriculum that incorporates current and landmark literature to provide a comprehensive, evidence-based foundation in anesthesiology.

Dr. Ameeka Pannu is program director for our highly competitive Critical Care Fellowship program, replacing Dr. Shahzad Shaefi following his years of excellent service; Dr. Shaefi was named vice chair of professional affairs in March of this year. Our highly sought-after Cardiac Anesthesia Fellowship has expanded to include the innovative Structural Heart Fellowship under the leadership of Dr. Ruma Bose. The Obstetrics Fellowship, under Program Director and Executive Vice Chair Dr. Philip Hess, continues to train outstanding obstetric anesthesiologists with extensive experience in peripartum and high-risk obstetric care. Our other non-ACGME fellowships continue to thrive as well. The Neuroanesthesia Fellowship is led by Dr. Richard Pollard; Dr. Shaefi leads Neurocritical Care (accredited by the United Council for Neurologic Specialties); and Dr. Andrey Rakalin has taken over the Regional Anesthesia Fellowship, which has expanded to two fellowship positions. Our newest fellowship, the two-year Perioperative Quality, Safety, and Innovation (QSI) Fellowship, is led by Dr. S. Krish Ramachandran. In addition to clinical and project work at Beth Israel Deaconess Medical Center (BIDMC), fellows obtain a master's degree in Healthcare Quality and Safety from the Harvard School of Public Health.



## Division Members

**Lauren K. Buhl, MD, PhD**  
Associate Program Director, Anesthesia Residency  
Instructor in Anaesthesia

**Lindsay A. Rubenstein, MD**  
Associate Program Director, Anesthesia Residency  
Instructor in Anaesthesia

**Daniel P. Walsh, MD**  
Associate Program Director, Anesthesia Residency  
Site Director for Critical Care, BID-Plymouth  
Instructor in Anaesthesia

**Scott D. Zimmer, MD**  
Director, Categorical Internship  
Director, Wellness and Mentoring  
Instructor in Anaesthesia

**Olaoluwakitan Awolesi, MD**  
Director, Medical Student Education  
Instructor in Anaesthesia

**M. Leo Tsay, MD**  
Director, Non-Anesthesia Trainees  
Instructor in Anaesthesia

**Lior A. Levy, MD**  
Director, Resident Simulation  
Instructor in Anaesthesia

## Fellowship Program Directors

**Ruma R. Bose, MD, MBBS**  
Program Director, Adult Cardiothoracic Fellowship  
Assistant Professor of Anaesthesia

**Philip E. Hess, MD**  
Executive Vice Chair, Anesthesia  
Program Director, Obstetrical Anesthesia Fellowship  
Associate Professor of Anaesthesia

**Robina Matyal, MBBS**  
Director, Vascular Anesthesia  
Program Director, Vascular Anesthesia Fellowship  
Leonard Bushnell Chair of Anaesthesia at BIDMC  
Associate Professor of Anaesthesia

**Ameeka Pannu, MD**  
Program Director, Anesthesia Critical Care Fellowship  
Instructor in Anaesthesia

**Richard J. Pollard, MD, FASA**  
Program Director, Neuroanesthesia Fellowship  
Director Pre-Admission Testing  
Director, Quality Improvement  
Assistant Professor of Anaesthesia

**Satya Krishna Ramachandran, MBBS**  
Vice Chair, Quality, Safety and Innovation  
Program Director, Perioperative Quality and Safety Fellowship  
Associate Professor of Anaesthesia

**Andrey Rakalin, MD**  
Director, Regional Anesthesia  
Program Director, Regional Anesthesia  
Instructor in Anaesthesia

**Paragi H. Rana, MD**  
Program Director, Pain Medicine Fellowship  
Instructor in Anaesthesia

**David M. Feinstein, MD, MS**  
Director, Clinical Informatics  
Program Director, Anesthesia Clinical Informatics Fellowship  
Assistant Professor of Anaesthesia

**Shahzad Shaefi, MD, MPH**  
Vice Chair, Professional Affairs  
Associate Professor of Anaesthesia

## Global Health Initiatives

**Edward Clune, MD**  
Chief of Anesthesia, Scottish Livingston Hospital, Botswana, Africa  
Program Director, Anesthesia Residency, SLH, Bostwana, Africa  
Instructor in Anaesthesia

**Eileen Stuart-Shor, RN, AGNP-BC, PhD**  
Director, Boston Africa Anesthesia Collaborative  
Consultant for Phebe School of Nursing, Liberia, Africa

**Yunping Li, MD**  
Division Director, Obstetric Anesthesia  
Associate Professor of Anaesthesia

**Brian P. O'Gara, MD, MPH**  
Section Head, Trauma Anesthesia  
Resident Program Director, Center for Anesthesia Research Excellence (CARE)  
Assistant Professor of Anaesthesia

**Nancy E. Oriol, MD**  
Faculty Associate Dean for Community Engagement in Medical Education, HMS  
Associate Professor of Anaesthesia

## Administrative Team

**Mary Jane Cahill, MBA, C-TAGME**  
Manager, Medical Education Programs

**Kimberley Brown**  
Fellowship Program Coordinator

**Michael Chen**  
Anesthesia Education Lab Assistant

**Roxanne Erikson**  
Residency/Fellowship Program Coordinator

**Ron Mayes**  
Program Administrator, Continuing Medical Education

**Alexandra Toussaint**  
Residency/Fellowship Program Coordinator

**Vanessa Wong**  
Project/Grant Coordinator, Education



Dr. Olaoluwakitan Awolesi has assumed the role of Director of Medical Student Education. Pinpointing the learning needs of everyone from beginning second-year clerkships to highly motivated visiting senior students “auditioning” for residency requires an uncommon degree of flexibility and enthusiasm. Dr. Meredith Colella will be moving into the role of associate program director for the Obstetric Anesthesia Fellowship, where she continues to mentor obstetrics anesthesia fellows and residents. Our head of the Vascular Anesthesia Division and a prolific education research mentor, Dr. Robina Matyal, was named as the inaugural Leonard Bushnell Chair of Anaesthesia at BIDMC in recognition of her contribution to the department and the field of anesthesiology at large, and she has also developed our newest fellowship in Perioperative Ultrasound and Clinical Anesthesia.

Dr. Scott Zimmer directs our categorical internship program, which is a highlight of our program and is highly sought after by our applicants. The internship includes a pain medicine month that offers early exposure to this anesthesia subspecialty and a chance for interns interested in pain to build mentorship opportunities. Interns also rotate through our intensive care units (ICUs), where they are integral to the team and foster relationships with our critical care staff as well as senior anesthesia colleagues. We have broadened our anesthesia education month dramatically to include introductions to the basics of anesthesia, obstetric anesthesia, and regional anesthesia in addition to TEE and TTE, with an overall emphasis on procedural learning and common clinical scenarios. The Division of Quality, Safety, Innovation and Information Technology facilitates a week-long program focusing on how anesthesiologists can take the lead on projects that improve the culture of safety within the hospital and remedy underlying systems issues that contribute to adverse outcomes. This program introduces the principles of root cause analysis and action (RCA<sup>2</sup>) using clinical examples that have been previously discussed and presented by our safety committee. The RCA<sup>2</sup> curriculum continues longitudinally into the residency program, where small groups of residents complete RCA<sup>2</sup> projects with the guidance of trained faculty and with the mentoring of our Quality, Safety, and Innovation Fellows.

Our faculty continue to drive innovations in medical education. Our comprehensive Education Lab houses a variety of task trainers, multiple computer stations, a projection screen and a huddle room. This space is not only the site for a variety of workshops and clinical skills sessions, but provides valuable space for learners throughout the department who are encouraged to utilize the lab for just-in-time procedural learning. This serves us well as we continue to shift the residency curriculum to a more competency-based model. Drs. Walsh, Buhl, and Matyal work to generate and incorporate comprehensive and interactive online modules and improved skills-assessment models for each of the subspecialty rotations.

The addition of community hospitals to our network has allowed us to offer our trainees a wide and varied experience. Our rotation at Mount Auburn Hospital in Cambridge gives our residents experience in complex cases in a community setting, and the addition of the New England Baptist



Hospital rotation provides an excellent opportunity for expanding regional anesthesia training in a high-volume, high-throughput clinical orthopedic hospital. On the global health front, Dr. Ed Clune, Chief of Anesthesia at Scottish Livingston Hospital in Botswana, Africa, continues to lead our global health rotation there. Although our international rotations (Botswana, China) have been on hiatus this past year due to the COVID pandemic, they remain among our most-requested rotations for residents.

Our department has a strong history in supporting a diverse and inclusive anesthesia community. We expanded our efforts in promoting health care equity by adding health care disparities education to our curriculum, expanding the implicit bias training offered to our application review committee and our staff at large, and increasing our outreach to students in the community. Dr. Walsh partnered with Dr. Nancy Oriol to increase our presence in the HMS MedScience program, which uses simulation to introduce high school students in the Boston area to careers in medicine. We are also creating opportunities for internships and co-ops for high school and undergraduate students to get exposure to a variety of experiences in health care offered through anesthesia and through our department. We look forward to expanding this program and incorporating more trainee and staff volunteers. We also offer a summer internship for high school students underrepresented in medicine. Our residents are active in seeking out opportunities to increase our visibility in support of Black lives and members of the LGBTQ+ community. Dr. Lindsay Rubenstein mentors trainees in advancing these efforts. She has enhanced our mentorship program by creating more structure and pairing small groups of residents and faculty together into “families,” which offers another avenue of support.

## Education Research

Medical education research has long been a focus of the Education Division. Our new Center for Education Research, Technology, and Innovation (CERTAIN), under the direction of Dr. Mitchell, has created a formal structure of support for faculty development and technical assistance for projects that take a novel approach to teaching and learning in a new era of more personalized, often remote didactics. Drs. Matyal and Feroze Mahmood are world-renowned experts in teaching perioperative ultrasound to trainees, nurses and faculty, and their longstanding program is thriving. Dr. Neves and Dr. Mitchell’s work to improve feedback on resident performance resulted in a recent publication in *Anesthesia and Analgesia* on using machine learning to evaluate, and ultimately improve, attending feedback. Drs. Walsh and Buhl pioneered novel approaches to didactics with two publications in *Anesthesia and Analgesia Practice*: Dr. Walsh described the development of an e-journal club curriculum to enhance intraoperative education, and Dr. Buhl described the development of a Choose Your Own Adventure-style branched-chain learning module to help medical students appreciate the complexities of anesthetic decision making. Dr. Buhl also drew from the world of quality improvement for her work published in the *Journal of Perioperative Medicine* showing how a more even distribution of ACGME-mandated cases can improve residents’ perceptions of fairness and balance.



Dr. Brian O’Gara guides our resident research efforts with the able assistance of the Center for Anesthesia Research Excellence (CARE), approving and coordinating research rotations and acting as a personal mentor for many. In the last year, the Resident Research Program granted elective research time to six residents. Our Loring Scholar program—a five-year clinician scientist research track—will graduate its first class at the end of June 2022. This integrated program, which pairs each scholar with an individual mentor, includes 18 months of research over five years of training. Our goal is to develop the next generation of anesthesiologist investigators.

## National and International Growth

Our division has a growing national reputation for preeminent education. Dr. Mitchell is president-elect for the Society for Education in Anesthesia (SEA). Dr. Neves is the chair designee for the SEA Committee on Resident Education. Drs. Mitchell, Sugantha Sundar, and Shaefi are American Board of Anesthesiology (ABA) Board Examiners. Drs. Mitchell and Matyal serve on the ABA OSCE committee, where Dr. Mitchell oversees the “interpretation of echocardiograms” section and serves as a committee vice chair. We have a partnership with Anesthesia Toolbox and its peer-reviewed curricular offerings, Dr. Mitchell serves on the Toolbox Executive Committee. Several faculty and trainees contributed modules to this peer-reviewed online resource. Dr. Mitchell is also Secretary of the Society of Academic Associations of Anesthesiology and Perioperative Medicine Board and vice president of the Interhospital Study Group, the authors of the Anesthesia Knowledge Test exam series. Drs. Pannu and Mitchell are contributing authors for *UpToDate Anesthesiology*. The education division has a significant presence presenting on education and other topics at national meetings, including the SEA, American Society of Anesthesiologists, Society of Cardiovascular Anesthesiologists and others. Dr. Sugantha Sundar directs the Harvard Anesthesiology Update each spring, an immense CME undertaking, with a large number of our faculty contributing lectures. In addition, our department runs the wildly popular Regional Anesthesia Workshop during the Anesthesiology Update. We offer Maintenance of Certification in Anesthesiology courses in the BIDMC simulation center on a regular basis, as well as our long-running Evaluating and Treating Pain course and several echocardiography and perioperative ultrasound offerings by our nationally renowned experts.



## BIDMC Anesthesia staff team up with Botswana Global Health Initiative

When BIDMC anesthesiologist Dr. Edward Clune arrived in Botswana with his family in 2017, his role was to help shore up critical care capacity, bring American residents to the country for rotations and provide training to local clinicians. He didn’t know that, in a few years, he’d be helping lead a Botswana-based anesthesia residency program set to graduate its first group of home-trained doctors in 2023.

Dr. Clune is part of the Botswana Global Health Initiative, initially launched in 2011 at Scottish Livingstone Hospital (SLH) in Molepolole, Botswana, to provide education, curriculum development and quality initiative support. At the time, SLH was able to provide straightforward internal medicine and OB/GYN care, but patients requiring more complicated treatment had to be transferred via a long ambulance ride to the larger hospital in the capital city of Gaborone. Dr. Clune became Chief of Anesthesia at SLH and joined the faculty at the University of Botswana, School of Medicine, the only medical school in this country of 2.3 million people.

Dr. Clune has brought residents from BIDMC and other American hospitals, to Botswana for training and to help provide anesthesia and

critical care. He helped build medical infrastructure at SLH; set up a larger intensive care unit (ICU) with 24-hour coverage; provides, along with residents, intensive care in the ICUs; and has conducted trainings for Botswana providers to improve their skill in critical care and non-routine medical procedures. He continues to fill in gaps when necessary, providing much-needed pediatric care and dealing with wildlife-related injuries like snake bites and even the occasional leopard bite.

Anesthesiology services are in high demand as well, since the limited number of anesthesiologists in Botswana are mostly foreign nationals like Dr. Clune. While providing local trainings, he and BIDMC OB/GYN physician Dr. Rebecca Luckett, who was also in Botswana, realized how powerful it would be if Botswana had a home-based residency program for anesthesia and critical care for the country to educate their own providers. Several residency programs had started in the years before Dr. Clune arrived but didn’t last very long. Drs. Clune and Luckett worked with their colleagues in Botswana to launch an anesthesia residency in 2019. The first class of residents are now in their second year of training at the University of Botswana in Gaborone.

Then COVID-19 reached Botswana. The country went into lockdown, American residents stopped coming, and only emergency cases were allowed in the operating rooms. Sir Ketumile Masire Teaching Hospital, a large hospital in the capital of Gaborone that was previously empty, was

opened up as a COVID-only unit, and Dr. Clune teamed up in the effort to create the critical care unit from scratch for COVID patients. The country was heavily impacted by COVID, but thankfully vaccinations started in March of this year.

The pandemic has not hindered Dr. Clune’s dream of having a self-sustaining residency program in Botswana. In addition to continuing his practice and education activities, he has put a more intense focus on the Botswana residents and their training. He spoke about his pride in the residents, his hopes for the program, and his belief this program epitomizes an ideal model for international collaboration and health equity:

“With the lack of much international presence here during the pandemic, the residents have really started to take ownership of their training. They’re taking an interest in research and heading up projects, with me in an advisory role. I answer questions, provide some guidance and then tell them to just run with it. There are times when it can be intimidating for them to work with international residents and fellows. I’ve learned, when left to their own devices, they are perfectly capable of running with an idea when they get it, and that’s a valuable thing. We want the initiative to come from them, and I’m proud to see how capable they are.

“It will be great when the international residents can come back in early 2022 to help out, but for now the Botswana trainees

are thriving on their own. We really want to make this program self-sustaining and have a permanent presence of rotating faculty at the University of Botswana, but I don’t want the program to rely only on us. My kids (8-year-old twin daughters and a 4-year-old son) are getting older, so we eventually want to return to the States, but I’d like to stay for a few more years. This is enough time to get some long-term goals accomplished and create a program where we help support critical care and anesthesia training that doesn’t depend on our presence.



“Overall, Botswana has done an incredible job of setting up a universal health care system and providing impressive access to educational opportunities. The concept of ‘botho’ — or, very simply put, ‘a respect for humanity’ — is shared throughout the Southern African region and no more so anywhere than in Botswana. The medical clinicians have a deep commitment to the care of their patients, and this is on display every day on the wards throughout the country. Our role is simply to provide support and resources where needed.”



The 2020 Excellence in Education awards were granted to graduating residents. As part of our resident-as-teacher track, residents receiving this award must commit time and energy to demonstrating expertise in teaching and education theory across a range of environments and situations. This past year, we were proud to recognize Dr. Mario Montealegre and Dr. Austin DeBeaux. We look forward to watching their future careers as anesthesia educators develop.

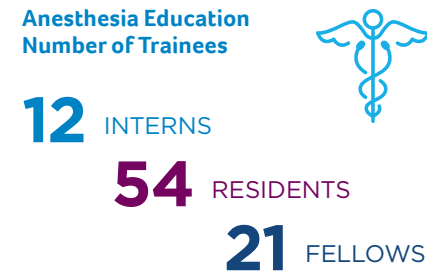
### COVID-19

We are incredibly proud of our department and trainee COVID response. The Education Division, including residents, fellows, and staff, were critical in the COVID response. Our clinicians intubated every COVID patient and staffed nine ICUs (an increase over the four BIDMC ICUs we typically cover), including three post-anesthesia care unit (PACU) ICU teams who utilized anesthesia machines as ventilators. We also developed COVID-19 intubation protocols and coordinated the training and simulation sessions for operating room and ICU staff in the safe management of COVID-19 surgical patients and parturients. In the ICUs, residents were critical to our ability to provide safe and effective care. Many of our residents volunteered to do additional ICU rotations to care for these patients. In the PACU ICUs, our residents further solidified their expertise by using several different types of ventilators, including anesthesia machines, in the management of severe respiratory failure. They were the experts redeployed nurses and respiratory therapists turned to when caring for these extremely complex patients.

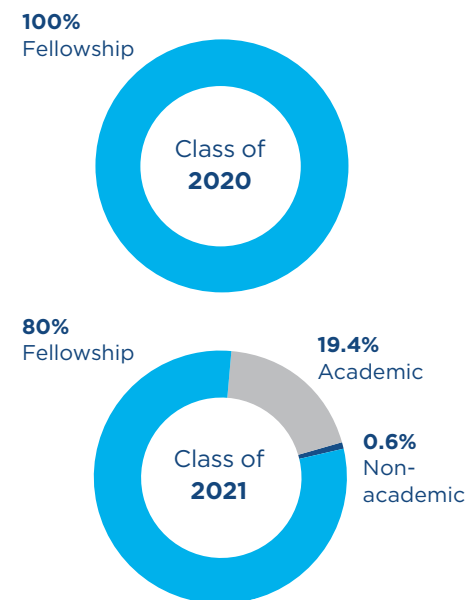
Our fellows helped organize and staff Boston HOPE, the COVID field hospital. Drs. Pannu, Matyal and Mitchell quickly organized and disseminated vast amounts of information for providers on up-to-date management of COVID as well as provided the just-in-time training needed for staff who were in unfamiliar and challenging environments.

In response to the pandemic, our department provided a robust wellness response to support our staff and trainees. Dr. Scott Zimmer organized virtual social events, including happy hour, yoga, and meditation, which were provided by members or friends of the department, and Dr. Lindsay Rubenstein developed the HEALS (Hearing Each other And Lending Support) pager: a 24-7 confidential hotline for any member of the department to get support.

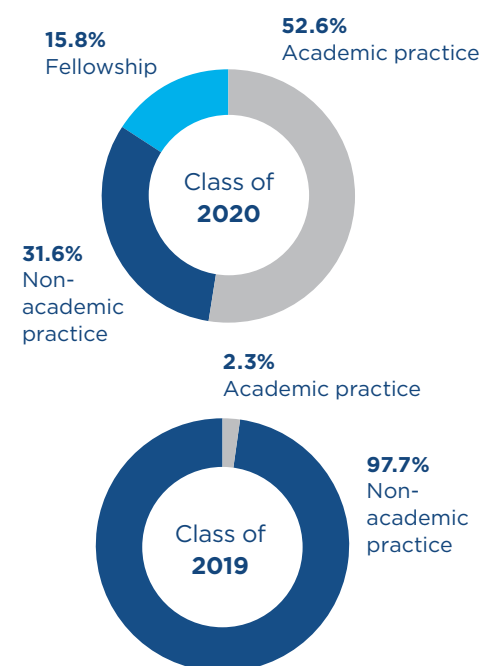
This past recruitment season was entirely virtual, so we undertook a complete restructuring of our recruitment and interview process. Our talented administrative staff — Mary Jane Cahill, Kimberley Brown, Roxanne Erekson, Alexandra Toussaint, Ronald Mayes, Taneshia Pina, Vanessa Wong and Michael Chen, along with chief residents Drs. Joseph Kalet, Gregory Kirby and Jinhui Zhao, helped convert information into an online format; and dinner chair residents Drs. Clare Eichinger, Sumanth Kuppalli and Dillon Schafer hosted unique and engaging virtual social events to share the BIDMC culture with applicants. This resulted in a very successful 2021 match. The future of education at BIDMC looks bright.



#### Percent of Residents Who Entered a Fellowship



#### Percent of Graduating Fellows entering Academic vs. Private Practice







**Professional  
Affairs**



# Professional Affairs



**Shahzad Shaefi, MD, MPH**  
 Vice Chair, Professional Affairs  
 Associate Professor of Anaesthesia

## Division Update

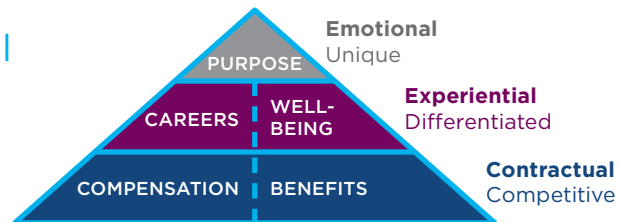
Our Professional Affairs team has reframed our vision and mission over the past year to be more inclusive and represent all members of our department. In 2020, we changed our name from Faculty Affairs to Professional Affairs to reflect our commitment to support the professional and personal development of not just clinicians but **all** of our staff. With this goal in mind, we have been hard at work examining our programs and structures of support to make them genuinely responsive to the needs of staff at all levels. This evolution is still in progress, and we continue to listen and learn to create a program that will enrich the experience of working in our department.

**Vision**—Our vision is to empower departmental members to discover and pursue a path to a fulfilling career so they may realize their full potential.

**Mission**—Our mission is to educate and support departmental members to develop sustainably as fulfilled, balanced and valued professionals.

**Ambition**—We recognize value and promote well-being in every person in our department by equitably supporting, cultivating and empowering personal growth and career development.

“Our vision is to empower departmental members to discover and pursue a path to a fulfilling career so they may realize their full potential.”



## Cross-Department Priorities

As we developed our five-year strategic plan, it was important to weave it into the structure of our existing departmental strategic plan. This is comprised of three pillars—education, clinical and research functions, with a foundation comprised of administration and executive leadership. Professional Affairs has been positioned foundationally to provide cross-pillar support for the department’s overarching goal of building and maintaining a world class department.

Currently the Professional Affairs Division contributes to a workplace culture and environment by hiring, developing, and retaining the best anesthesia providers.

We are responsible for faculty recruitment, hiring and onboarding, credentialing, annual reviews and promotions at HMS, mentoring for faculty, performance appraisal and management and faculty development, among other functions.

## Recruitment and Onboarding

We have grown to be an exceptionally large yet nimble department, and our rapid growth over the last 10 years has brought new challenges and opportunities related to recruiting across both our strategic pillars and the network.

We strive to prioritize the candidate experience during recruitment. This has been particularly important during 2020-2021, when we converted to a mostly virtual process due to the COVID-19 pandemic. Over the last 18 months, we redesigned our recruitment interface and experience to include more personal outreach and communication for interested candidates. We started using physician liaisons to allow for a true and meaningful conversation with candidates while they are considering employment here. Our administrative staff has facilitated this by sourcing, organizing and communicating with prospective members of the department. In the last two years, we recruited and hired approximately 48 MDs and 43 certified registered nurse anesthetists (CRNAs) at over eight sites.

We are also developing a more holistic recruiting experience, with assistance and information around issues formerly considered non-work related. These range from information on living in and around Boston to school districts to introductions to departmental members with similar training and experience levels.

Once hired, we have an in-depth onboarding process, starting with a two week, hands-on orientation period guided by an experienced faculty mentor. We are also reinvigorating and expanding our initial orientation program with the SCORE Program (Strategies for Clinician Onboarding, Readiness and Early Mentorship). The SCORE program will create a comprehensive library of clinical, mentoring, administration and professional standards materials using varied media that will allow new staff to seamlessly integrate into the department. We are starting this first at BIDMC and looking to rollout across the community sites in the near future.

### Administrative Team

**Susan H. Kilbride, BSN**  
 Director of Professional Affairs and Recruitment

**Diane Baranowski**  
 Project Administrator, Credentialing, Privileging and Enrollment

**Yvette Dusabe**  
 Administrative Coordinator, Professional Affairs and Recruitment

**Rosanna Kelleher**  
 Professional Affairs, Physician and Certified Nurse Anesthetist Recruiter

**Nora McCarthy**  
 Project Administrator, Professional Affairs and Recruitment

**Letisha Phillips**  
 Project Administrator, Credentialing, Privileging and Enrollment

**Taneshia Pina**  
 Project Administrator for Education and Professional Affairs



48 MDs & 43 CRNAs  
 hired FY19-20  
 over 8 SITES



## Credentialing

Our credentialing team functions in the background, working to steer our clinical staff through the increasingly complex world of credentialing both at BIDMC and our community sites. They complete initial credentialing and re-credentialing for new and existing staff in addition to hospital, site and insurance appointments and re-appointments for all faculty members, CRNAs and nurse practitioners. They also renew state and federal certification for controlled substances and basic life support and advanced cardiovascular life support certification; assist with visa applications and processing; complete occupational health clearances; and link payors. In the past two years, the team has completed roughly 200 appointments and re-appointments for new and existing faculty.

## Mentorship and Sponsorship

Building relationships with staff and tapping the support of senior leadership are critical to the success of our mentoring program. We have primarily worked with executive leadership and incoming faculty to develop our current mentoring program.

Our primary goals are to:

- Explore and implement, in collaboration with division heads, the Professional Affairs resources across the department
- Continuously evaluate and develop strategic goals for the Professional Affairs group as environments change
- Facilitate work assignments to address current staff interests and career advancement
- Coordinate individualized career-development plans across the strategic pillars of our department
- Enhance collaborations between departments that have a positive impact on a greater number of faculty
- Strengthen the role of mentors in the department

A key initiative over the coming year is to develop and implement a formal Individual Development Plan (IDP) for all faculty. Subsequently, this will also be explored and extended to the support staff and administrative staff in the department. Both in industry and more recently in medicine, there is growing evidence that a separate process not tied to performance, employment continuation, promotion or finances has a central role to play. Initially, the IDP process would be formulated by our faculty and cover various aspects, including skills assessment (clinical and non-clinical), time allocation (clinical commitment), career goals and impediments to progression, and specific time-stamped objectives. A series of SMART goals (Specific, Measurable, Achievable, Realistic, and Timely) will be developed around mentorship groups, sponsorship opportunities, promotional timelines, burnout mitigation, faculty club enrollment, schedule flexibility and more. The annual IDP process will form the cornerstone of professional development for faculty and anesthesia providers.

### Individual Development Plan

- Skills Assessment
- Time Allocation
- Career Goals/Barriers
- Specific Objectives

## Leadership Development



Above and beyond our goal to mentor all faculty and anesthesia providers, a key part of successful transition and succession planning is identification and development of emerging leaders. There are various challenges when searching for diverse leaders who exhibit leadership and management skills in addition to clinical, research and educational excellence. Recruiting, identifying, investing in, impacting, shaping and sponsoring potential leadership candidates from within remains crucial. We currently have a number of existing pathways of development in this area.

### Anesthesia Leadership and Executive Operations Fellowship (ALEOF) Program

The ALEOF program is a one-year leadership pathway program that offers an opportunity to work alongside the department's executive leaders. This clinical leadership pathway was created for experienced faculty to work with executive mentors to develop and implement high-impact projects that support the department's strategic plan. These projects provide experience in specified areas across the departmental strategic development areas, such as:

- Administration
- Clinical operations
- Diversity, equity and inclusion
- Education
- Professional affairs
- Research
- Quality, safety and innovation

Previous or current ALEOF fellows include anesthesiologists: Dr. Akiva Leibowitz, Dr. Lindsay Rubenstein, Dr. Soumya Mahapatra and Dr. Leo Tsay.

The department has also continued its strong partnership and commitment to the network-wide Physician Leadership Program. This is a 12-month program for early to mid-career physicians who are in a leadership role within the network. Recent graduates include Drs. Shahzad Shaefi and Sara Neves.





## Promotion

One of the major hallmarks of both individual and collective success is the rate and status of academic promotion. The academic promotion process at Harvard Medical School is often lengthy and rigorous, and faculty members benefit from guidance. Over the last few years, we have made many inroads into an increased transparency of the promotions process. A Promotions Committee was formed, a representative from Harvard Medical School's Department of Faculty Affairs gave grand rounds on academic promotion and our compensation plan now rewards academic promotion more notably than it had previously.

To improve the department's process and likelihood of a candidate's academic advancement at Harvard Medical School, we restructured the Anesthesia Academic Promotion Committee as part of the Professional Affairs mission to both develop and support the members of our faculty. We created several pathways for staff to enter the academic promotion pipeline. Potential promotion candidates may now approach a Promotions Committee Member, Division Director or Mentor with a request for a CV review and discussion. Once the candidate is reviewed by the Promotion Committee, a committee member volunteers to be a promotion mentor to assist the candidate through the process for submission to HMS. We have had great success with this model, as it gives more individualized support to each candidate.

Future endeavors will focus on exploring use of new technology that allows for review of a candidate's academic work in an automatically produced Harvard Medical School Curriculum Vitae. Importantly, this will highlight metrics that can be used to assess a candidate's readiness objectively and through regularly generated reports. Drs. Talmor and Shaefi will continue to drive the Promotions Committee, but with an increasing pivot to a roadmap and timeline for faculty to approach promotions as detailed in their IDPs. This will include individual benchmarking with strong mentoring and continued sponsorship.

## Wellness, Resilience and Sustainability

The importance of physical health and well-being for our employees has never been more critical to the department. The continuous churn of a worldwide pandemic, coupled with social and political crises, has created levels of stress unique to health care workers. Due to the pandemic, our current in-person wellness events established by the Director of Wellness, Dr. Scott Zimmer, were revamped as virtual offerings, with exercise classes and yoga, happy hours, hobby and book clubs, etc., offered via Zoom. However, the need for more support and a broadening of our original wellness mission was evident. We developed several unique new programs this past year, the Heals Pager, the Diversity, Equity and Inclusion Focus Group, the HOPE project and the Department Code of Conduct chief among them.

## BIDMC Anesthesia Wellness Programs



We believe the best defense against staff feeling overwhelmed and burned out is a reliable support network that fosters a sense of connection and shared purpose. Better quality of life and professional satisfaction leads to better health and creates a more effective workforce that will excel at patient care, teamwork and other important functions.

Our wellness program began with events like happy hours, picnics, charitable drives and contests, and later expanded to include yoga classes and breathing, meditation and exercise instruction. Our department has grown, and we now have staff at many different locations. One aim of our wellness program is to bring people together who do not usually work together and create a sense of partnership and cohesion.

When the COVID-19 pandemic hit, and our frontline clinical staff were in the midst of unprecedented viral storm, our ICUs were full of patients suffering from a new virus that our staff had never encountered before. There was a high emotional toll to witnessing loss of life and the heartbreak of very ill patients isolated from their families.

Our wellness committee stepped up to the plate. Given that all in-person activities had been cancelled, they offered more frequent online exercise and yoga as well as tai chi classes. We also sent gift cards to employees personally affected by COVID-19. In addition, our monthly newsletter came out weekly during the worst of the crisis to provide additional morale-boosting and information. It contained "shout-outs" to commend members of our staff for going above and beyond and updates from our sites about how they were rising to the occasion to cope with the COVID crisis in the community centers.

The COVID-19 pandemic brought us together as a department, and our wellness program was the vehicle that allowed us to communicate with and support one another during a devastating clinical crisis. We provided a venue to share admiration and gratitude for the amazing skill, compassion and teamwork demonstrated by our entire clinical staff. As the first COVID surge waned, we surveyed our staff and found that a large majority felt supported by and appreciated our wellness efforts.

As we look forward to hosting in-person events again, we thank each and every one of our staff for their hard work and dedication during this challenging time. We remain committed to their well-being and professional satisfaction as we continue to grow and thrive as a clinical department.

## Peer Support Programs

Peer support for individual clinicians and staff is an important component of our wellness program. Our efforts in this area include two different forms of support for clinicians who have been involved in adverse clinical events and staff who are experiencing stress and personal and/or professional crises.

**The Peer Support program** alerts one of our hospital-trained department peer supporters about clinical events requiring an intervention in several ways. Unexpected adverse clinical events can traumatize the involved clinician, leading to guilt, isolation and professional burnout. Peer support with an empathetic colleague is an invaluable tool to combat the stress and discomfort that can result from distressing clinical events. The first method flags traumatic clinical events when they are documented in our electronic anesthesia record system. A trained peer supporter reaches out without being intrusive, since clinicians might not reach out themselves due to the shame and guilt that can accompany these events. Flagged events include intraoperative death, cardiac arrest, and inability to intubate and ventilate. The second method identifies cases using a simple electronic referral form on our anesthesia intranet that can be filled out by anyone in the department. After the form is sent, a peer supporter is notified and reaches out to the clinician for an initial conversation and determines if follow-up support would be helpful. This tool is especially valuable for floor managers, since they have an excellent global sense of traumatic events or distressed colleagues on any given day. This program has gained increased visibility both in our department and in the hospital, and has been lauded as a model for peer support to ensure that clinicians do not suffer alone after difficult outcomes.

**The HEALS Pager** is available to all department members experiencing stress or frustration who want to speak with a supportive colleague who can listen and suggest more formal support options if necessary. The system is accessed through the hospital's pager system, and there is a HEALS-trained supporter on page who returns the call. The supporter offers what help they can while reminding the caller that they are a friend and colleague with some peer-support training, but not a trained mental health professional. These conversations are kept confidential except in rare circumstances when there are safety concerns for the caller or others.



### Wellness Fund

The Wellness Fund supports the valuable work of the Wellness Committee to bolster the health and spirits of our clinicians and staff. Some initiatives funded include: professionally led virtual exercise classes, department-wide social events, initiatives to promote diversity, equity and inclusion and launching the HEALS pager.



In recognition of the importance of the Wellness Initiatives, our first significant donation to the fund was made by a department member.

### HEALS Pager

Our HEALS Pager (Hearing Each Other and Lending Support) is a program put in place to allow all staff who are experiencing difficulties to contact a supportive colleague to talk and receive support. The service is available 24 hours a day, seven days a week. The calls are completely confidential except in rare instances when there is concern for the caller's safety or the safety of others. We encourage staff to use this resource if they need to talk to someone who has received peer support training, who is a good listener and who can provide empathy and support. Dr. Lindsay Rubenstein leads this effort.

### Diversity, Equity and Inclusion

A significant development over the past year is the creation of our department's new Code of Conduct, summarized by the acronym WELCOME.



#### Code of Conduct

Our community embraces these values, and we ask that all our members model this behavior, every day, every time.

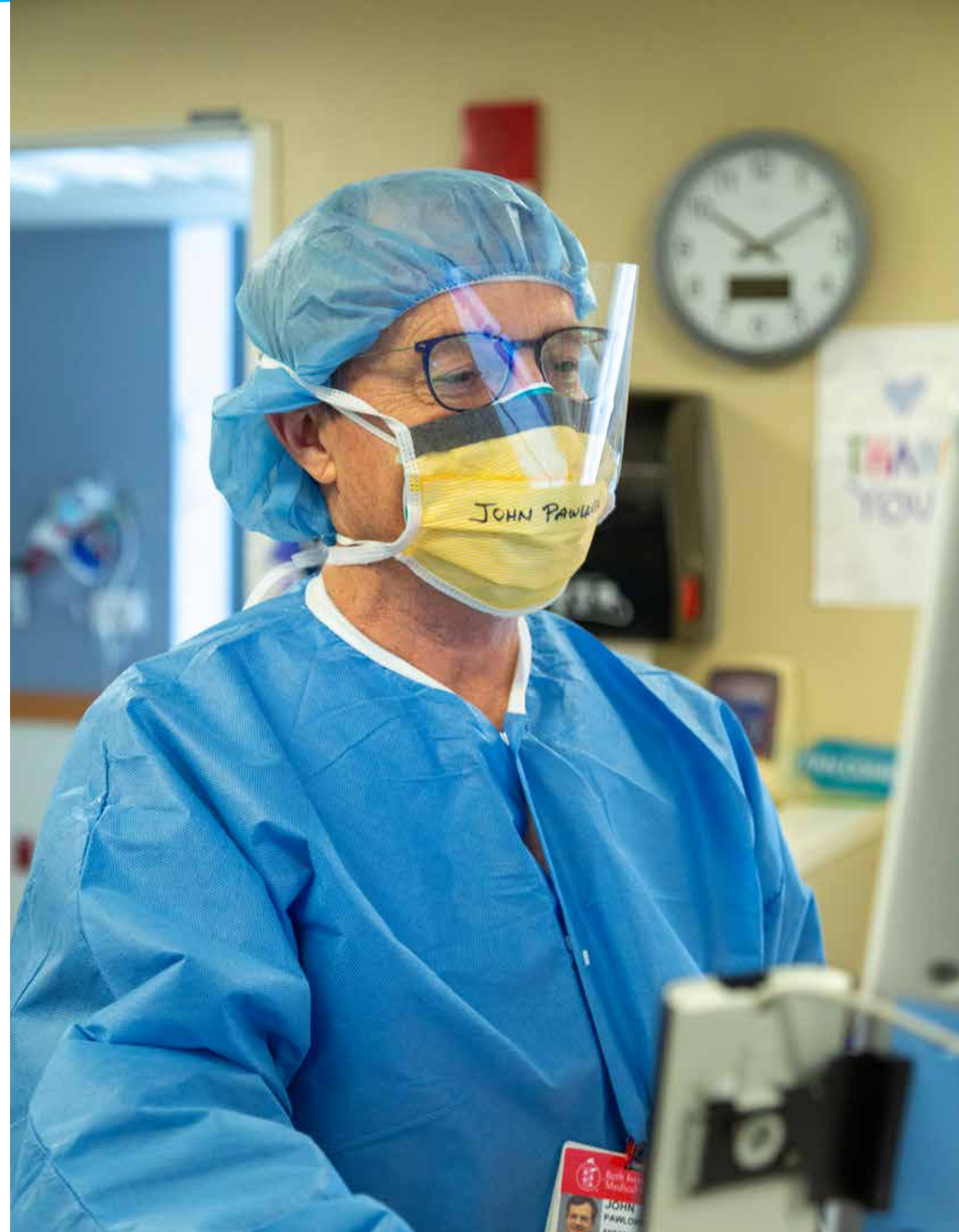
<b>W</b>	<b>Workplace</b>	Create a collegial and safe workplace
<b>E</b>	<b>Equity</b>	Equitable and fair treatment for all
<b>L</b>	<b>Listening</b>	Listen respectfully
<b>C</b>	<b>Communication</b>	Communicate frequently in a transparent, courteous and caring manner
<b>O</b>	<b>Opportunities</b>	Create and pursue opportunities for growth and development
<b>M</b>	<b>Mindful</b>	Be mindful, observe yourself and treat others the way they want to be treated
<b>E</b>	<b>Educate</b>	Empower others and model welcoming behavior

This positive ethos already existed in the department, but we created this code to reinforce and build on our welcoming reputation. The idea came out of the Equity Focus group, whose members worked together to create this code to represent our vision of how we treat each other and welcome new staff.

### The Diversity, Equity and Inclusion Focus Group

The Anesthesia Department's Equity Focus group is the proving ground where ideas and strategies are developed and operationalized for our current and proposed diversity, equity, inclusion and outreach projects and initiatives.

In the last two years, we have seen increasing change, stresses and extrinsic pressures in the workplace. Successfully providing opportunities for robust professional development to promote and drive retention, satisfaction, wellness and sustainability within a diverse and inclusive framework ultimately strengthen the collective department. We look forward to continuing this important work.







**Quality , Safety,  
Innovation and  
Informatics**



# Quality, Safety, Innovation and Informatics (QSII)



**Satya Krishna Ramachandran, MD, MBBS**

Vice Chair, Quality, Safety, Innovation and Informatics  
Program Director, Perioperative Quality and Safety Fellowship  
Associate Professor of Anaesthesia

“We inspire our people to maximize individual and organizational value through adoption of innovative technology, informatics, learning health systems, citizenship behaviors, and world-class standards and processes.”

The Division of Quality, Safety, Innovation and Informatics (QSII) supports the delivery of safe and efficient patient care through processes directed at the site, division and individual level. The three foundational arms of this division aim to create more effective ways to modify both human and system drivers of quality and safety.

## Clinical Quality

The QSII leadership group comprises site directors, quality leaders, IT experts, project managers and support staff who are actively engaged in developing quality and safety programs, as well as research and data visualizations for both process and outcome metrics relevant to our constituencies. This data-visualization engine combines data from multiple local and organizational databases in order to link processes of care with outcomes that matter to our patients, department and organization.

Specific cross-departmental issues identified through threshold indicators are explored in depth through the Faculty Hour mechanism using multidisciplinary project teams. It is estimated that the combined efforts of these project teams continue to reduce hospital costs by several million dollars a year while enhancing patient safety. Our highly successful project management team supports clinical leadership in executing key interventions.

## Clinical Safety

During the past several years, we have continued to use system-based quality assurance (QA) methods to enhance the quality and safety of clinical care. This philosophy is evident in our new Morbidity and Mortality (M&M) structure, unveiled in 2019, and provides a standardized set of support tools to improve both individual and organizational learning from adverse events or close calls. Peer review is performed by the Professional Standards Committee and is designed to evaluate individual competence through Ongoing Professional Practice Evaluation standards and investigate concerns with standards of care or professionalism through Focused Professional Practice Evaluation.

The Safety Committee comprises 18 standing members trained in industry-standard techniques for retrospective and prospective safety investigations. Their focus is on identifying systems factors that cause or contribute to actual patient harm or increased risk thereof. Through standardizing these review processes, we created a mechanism to perform numerous processes, including robust event reviews, root cause analyses, safety assurance and failure mode effects analyses. Through a



### Quality, Safety, Innovation Team

**Sarah Y. Nabel, MS**  
Director, Quality, Safety, Innovation & Informatics  
Associate in Anaesthesia, HMS

**Richard J. Pollard, MD,**  
Director, Safety  
Director Pre-Admission Testing  
Director, Neuroanesthesia Fellowship  
Assistant Professor of Anaesthesia

**David M. Feinstein, MD, MS**  
Director, Clinical Informatics  
Program Director, Anesthesia Clinical Informatics Fellowship  
Assistant Professor of Anaesthesia

**Cullen D. Jackson, PhD**  
Associate Director, CERTAIN  
Instructor in Anaesthesia

**Robert A. Carlin**  
Senior Project Manager

**Reshma Abraham, MPH**  
Project Manager

**JoAnn Jordan, MS**  
Senior Data Project Manager

**Andrea Azocar**  
Research Assistant

### Quality & Safety Fellows

**Nadav Levy, MD**

**Liana Zucco, MBBS, MSc**

**Salameh Obeidat, MD**

**Matthew Needham, MBBS**

Delphi approach, the Safety Committee developed a HIPAA-compliant safety review process that can support event review from multiple locations within the network hospitals covered by Associated Physicians of Harvard Medical Faculty Physicians.

In addition to event-based processes, the committee also tracks national safety indicators and investigates threshold changes in concert with clinical leadership. The department performs more than 35,000 anesthetic procedures annually using an electronic anesthesia information system. Approximately 99% of the cases are associated with no adverse intraoperative events. However, nearly 1% (or about 300 cases per year) do have one or more events. These cases are reviewed and appropriate follow-up determined. Major adverse events are presented at the twice-monthly multidisciplinary hospital Quality Improvement Directors meeting for further review and potential reporting to state agencies.

## Team Training and Projects

The Controlled Risk Insurance Company (CRICO) is the malpractice insurance provider for our Anesthesia Department attendings, residents and fellows. The CRICO premium reduction program has been credited with significant improvements in anesthesia safety, resulting in a four-fold reduction in premiums over the past few decades. Our premiums today are among the lowest in the United States. This less-appreciated perk of working in our department contributes directly to these cost savings while incentivizing activities that have been proven to improve patient-safety culture. Although our certified registered nurse anesthetists (CRNAs), currently insured through a hospital nursing coverage mechanism, are technically outside the CRICO coverage, we intend to expand this program to include our CRNAs in the four-hour simulation activities going forward.

CRICO's Premium Reduction Program provides guidelines for specific trainings that clinicians are expected to take over a three-year period to realize a cost-savings on their malpractice insurance and to learn teamwork best practices that enhance patient outcomes. Our QSII team designs and runs this training program for the department, which includes short drills and 4-hour simulation-based courses, in collaboration with our surgical and nursing colleagues.



Despite all of the disruption caused by COVID-19 during 2020, we came together to ensure we were able to continue to participate in this important training and cost-savings program. As a result, 93% of our insured clinicians took the required training in 2020 to satisfy CRICO requirements, creating premium savings of over \$900,000, with similar savings over the past three years. Last year's program provided interdisciplinary training to over 400 perioperative staff in the new and evolving COVID-19 protocols by creating innovative ways to safely bring back together staff who had been separated by MA state regulations to pause surgeries, redeploy staff and work remotely. These savings help us fund innovative programs and staff in the QSII group.

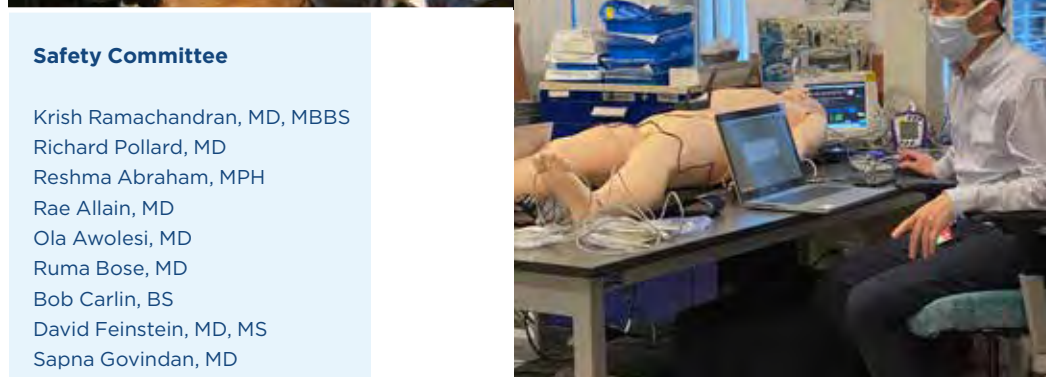
We also have ongoing faculty and CRNA training. More faculty members joined the safety committee in 2019 and have been trained as trainers for the Improving Root Cause Analyses and Actions to Prevent Harm, or RCA2, methodology, bringing the total number of trained faculty in the department to 14. They are mentoring residents in RCA2 projects currently and throughout the year.

We published the BIDMC Emergency Manual in 2020, a compendium of cognitive aids to support crisis management in the operating room (OR). Several super trainers, including anesthesia and nursing staff, were trained in the use of the emergency manual for the rollout in 2021. This program is intended to focus on team training around events directly relevant to anesthesia care and enhance in situ performance of teams during actual crises.

### Quality and Safety Education

We successfully integrated an expanded quality and safety training program for postgraduate residents, fellows and faculty over the last two years. The intern QA week is now a fully mature immersive program with lectures from nationally renowned experts in quality, safety, informatics, operations and human factors. Our interns presented two projects focused on neuromuscular transmission monitoring and inflectional control measures around airway management. Starting in 2019, this program has hosted exceptional students from England through the Meghana Pandit Safety Scholarship, a collaboration with the University Hospitals of Coventry and Warwickshire.

Under the course directorship of Dr. Sara Neves and co-directorship of Drs. Nadav Levy and Liana Zucco, we completed four full years of RCA2 training for the third post-graduate year (PGY-3) class. Our residents have completed over 15 RCA2s over the last four years. Through this program, residents and faculty trainers are employing industry-standard techniques endorsed by the Institute for Healthcare Improvement and the National Patient Safety Foundation. We also defined the Implementation Science Training Curriculum for the PGY-4 (CA-3) residents. The goal is to train our residents in the approach and methodology for influencing and implementing change in health care environments. The program was developed through collaboration with Dr. James Bagian and Joseph Derosier, PE, CSP, two pre-eminent leaders in patient safety, internationally renowned for their work in the National Center for Patient Safety and their authorship of the RCA2 methodology.



**Safety Committee**

- Krish Ramachandran, MD, MBBS
- Richard Pollard, MD
- Reshma Abraham, MPH
- Rae Allain, MD
- Ola Awolesi, MD
- Ruma Bose, MD
- Bob Carlin, BS
- David Feinstein, MD, MS
- Sapna Govindan, MD
- Cullen Jackson, PhD
- John Kowalczyk, MD
- Megan Krajewski, MD
- Lisa Kunze, MD, PhD
- Rikante Kveraga, MD
- Nadav Levy, MD
- Soumya Mahapatra, MD
- Sarah Nabel, MS
- Matthew Needham, MBBS
- Sara Neves, MD
- Salameh Obeidat, MD
- Edward Plant, CE
- Andrey Rakalin, MD
- Paragi Rana, MD
- Scott Zimmer, MD
- Liana Zucco, MBBS, MSc



### Fellowship in Perioperative Quality and Safety

A two-year PGY-5 fellowship in Perioperative Quality and Safety was approved as a non- Accreditation Council for Graduate Medical Education (ACGME) program by the BIDMC Graduate Medical Education Committee and endorsed by the ABA in 2018. This program has hosted two exceptional international post-residency fellows each year for the last two years. Fellows will receive the **Master of HealthCare Quality and Safety** degree from Harvard Medical School. A collaboration was finalized with the Royal College of Anaesthetists and the Association of Anaesthetists of Great Britain and Ireland through the Safety Liaison Group to host fellows at Beth Israel through this mechanism. This provides a tremendous opportunity for us to develop internationally recognized leaders in health care quality. We look forward to our inaugural fellows, Dr. Liana Zucco and Dr. Nadav Levy, graduating from the program in June 2021. Our current fellows, Dr. Salameh Obeidat and Dr. Matthew Needham, join us in welcoming the incoming fellows, Dr. Catriona Stewart and Dr. Mitra Khany, to the program. Dr. Zucco and Dr. Levy are co-directors of the resident RCA2 training program for all residents and, along with other fellows, lead the M&M reviews.

Our fellows have led the way with several key programs. These include developing the COVID perioperative flows; implementing high-flow nasal oxygen across all ORs; same-day joint arthroplasty pathways; radiation safety; and OR team training, including emergency manual implementation, perioperative communication in pre-admission testing, development of an adverse-event toolkit and debriefing after major adverse events in the OR. They are also involved in multiple studies and have published extensively in 2020. Ongoing projects include the CRICO-funded "CONCISE" project, a collaborative prospective study with Ariadne Labs that explores the relationship between frequency of in-situ drills and several measures of organizational safety. Other studies include evaluation safety in airway management, low-flow anesthesia, intraoperative hand-offs, debriefs, analgesic adjunct usage, neuromuscular blockade and reversal and volatile anesthesia and various analgesic therapies.

### Information Systems

#### Anesthesia Information Management Systems

In May of 2020, we introduced Talis, our new Anesthesia Information Management System, in all areas providing anesthesia care at BIDMC Boston with the exception of Labor and Delivery, which will go live in June 2021. Prior to Talis, we have used Philips Compurecord since 2005. We are working with Talis to co-develop a fully integrated intensive care unit electronic health records system that will allow for improved access to data and streamlined continuity of care for critical care patients who receive anesthesia services. In our community sites at BID-Needham and BID-Milton, we continue to use the iPad- and cloud-based Shareable Forms documentation platform, which was implemented in 2015.

**IT, Informatics & Data Management Team**

- Sarah Y. Nabel, MS  
Director, Quality, Safety, Innovation & Informatics
- Matthew Bornstein, MS, CPHIMS, SHIMSS  
Manager, Anesthesia Systems & Data Management
- Tom Xie, MS  
Manager, IT Operations
- Laura Ritter-Cox, MSN, RN-BC  
Nurse Informatics Specialist
- Praveena Muthuraj, MS  
Application Architect
- Tuyet Tran, MS  
Data Analyst
- Jo Ann Jordan, MS  
Senior Data Project Manager
- Rob Ruiz  
Technical Analyst
- Jobe Diagne  
Technical Analyst
- Nick Latta  
Application Analyst



### Datamart Team

The Informatics and Data Management team have conducted numerous projects directly supporting QI, research and operational goals. Starting in early 2020, the team architected, developed and tested a new Datamart for the collection and analysis of Talis data. In collaboration with the hospital Business Intelligence team, the final product is nearing completion and will soon be housed as part of the larger master data warehouse project currently in development by BIDMC Information Systems. Part of this initiative entails development of a data-integration plan in order to achieve a unified view of the data across both Compurecord and Talis for reporting and analysis purposes. As a result of this work, we successfully built data models and dynamic visualizations for a variety of anesthesia-specific and interdisciplinary projects, including postoperative nausea and vomiting, personal scorecards, pharmacy-controlled substance surveillance, first case starts, and a series of division director dashboards.

### Fellowship in Clinical Informatics

The Division of Clinical Informatics Fellowship Program at BIDMC is a two-year multidisciplinary fellowship in collaboration with five BIDMC departments: Anesthesia, Emergency Medicine, Radiology and Pathology. The program offers six annual positions and trains participants to creatively utilize information and communication technology to transform health care. Fellows are exposed to our state-of-the-art clinical computing systems and learn to assess needs, refine clinical processes and design and implement clinical systems. The program was ACGME-accredited as of July 2015. Each fellow completes a research project, is encouraged to obtain a Masters in Biomedical Informatics and completes the Program in Clinical Effectiveness at Harvard School of Public Health. Dr. David Feinstein is the program director for the Anesthesia Department portion of the Fellowship.

### Anesthesia Department Intranet Project

The Department of Anesthesia, Critical Care and Pain Medicine has had a robust intranet site since its inception nearly two decades ago. The site has evolved over the years to meet our more complex needs as the department has grown due to new affiliations and involvements with satellite hospitals. We are currently working to design a new intranet site that is even more user-friendly and delivers content that matches our needs as a world-class Department of Anesthesiology.



### Innovation

Our innovation efforts are directed to discover improvements that will positively impact health care delivery in the perioperative environment. This work involves both quality-improvement initiatives and rigorous research projects. The results influence areas such as team and organization design, communication pathways and transitions of care, information management systems, and training and education. By virtue of being part of the Anesthesia Department, we work across all phases of the perioperative environment (pre-, intra-, and post-operative). We also strive to work across departments—Surgery, Orthopedics, Obstetrics/Gynecology, Perioperative Nursing, Pharmacy, and Healthcare Quality and Safety—to ensure our improvement and research efforts encompass the interdisciplinary nature of our perioperative work.

### Faculty Hour Chartered Teams

In 2019, we celebrated the ninth anniversary of the launch of Faculty Hour. Started in April 2010 through the leadership of Dr. Brett Simon, Faculty Hour affords anesthesiologists, surgeons, nurses, and others in the community the opportunity to meet once each week at the start of the day (currently Tuesday mornings) to advance quality and outcomes for patients, accelerate learning and innovation and foster mutual joy in work. In order to facilitate this multidisciplinary opportunity, OR start time is set 30 minutes later, which shows the tremendous endorsement and investment that BIDMC and the participating departments make in the Faculty Hour program.

Multidisciplinary teams lead projects initiated by clinical providers within the medical center and chartered by the Faculty Hour Steering Committee, which comprises leaders from Anesthesia, Surgery, Perioperative Services, Orthopedics and Obstetrics/Gynecology. These “chartered” teams are guided by input from various sources: other health care providers, patient advocates from the Patient-Family Advisory Council, observations of external facilities and processes and more. A triad leads each team to strengthen the multidisciplinary nature of the project and to ensure endorsement across the constituent departments. They recruit additional members (generally six to 10) to complete the team’s membership. Each Chartered Team is supported with data, literature and a facilitator trained in process improvement (as well as other resources as needed). To date, over 60 interdisciplinary teams have completed projects, and there are generally three to six projects in progress or in the planning stage at any given time.

In addition to our focus on improvement, the division also conducts cutting-edge applied research focused on enhancing our methods for evaluating and implementing solutions for both our quality and safety missions. Over the past three years, we have been actively engaged in human factors and cognitive systems engineering research to understand and mitigate safety and quality vulnerabilities for our individual providers, teams and systems. Currently, our research focuses on three areas: individual performance assessment and augmentation; simulation-based training and education, and system-level collaboration and resilience.







# Research Centers/ Labs



# Introduction



**Simon C. Robson, DCH, MBChB, PhD, FRCP, FAASLD**

Vice Chair of Research  
Charlotte F. & Irving W. Rabb Distinguished Professor of Gastroenterology and Hepatology  
Joseph J. and Josephine A. Gazzola Chair in Inflammation Research  
Director, Center for Inflammation Research

“Our goals are the development of collaborative and innovative research programs, resulting in enhanced patient care, advances in scientific knowledge, and the training of the next generation of researchers and clinician scientists.”

Research in the Department of Anesthesia, Critical Care and Pain Medicine at BIDMC and affiliates includes a wide range of investigations, from basic mechanistic studies to translational research and diagnostics, to clinical trials underpinning COVID-19 management in the ICU.

Research leadership has been provided by Drs. Danny Talmor (chair); Simon C. Robson (vice chair, Research); Rami Burstein (vice chair, Neuroscience); Matthias Eikermann (vice chair, Faculty Affairs, until March 2021); Shahzad Shaefi (now vice chair, Professional Affairs); Balachundhar Subramaniam (director, Center for Anesthesia Research Excellence, or CARE, until 2020 and current director of the newly formed Sadhguru Center for a Conscious Planet); Maximilian Schaefer (director of CARE, and director of Perioperative Outcomes Research from March 2021 onward); Brian O’Gara (director of Resident Research); John Mitchell (director of the Center for Education Research, Technology and Innovation (CERTAIN); Alexander Shtifman, Administrative Director of Research; and Valerie Banner-Goodspeed, Anesthesia Research Program Manager.

We congratulate Dr. Matthias Eikermann, who left to become Chair of Anesthesiology at Montefiore Medical Center and the Albert Einstein School of Medicine in New York.

## Recruitment and the Sadhguru Center

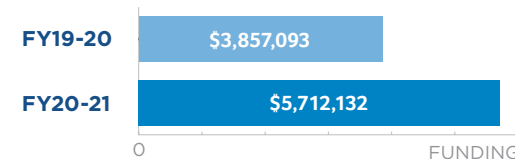
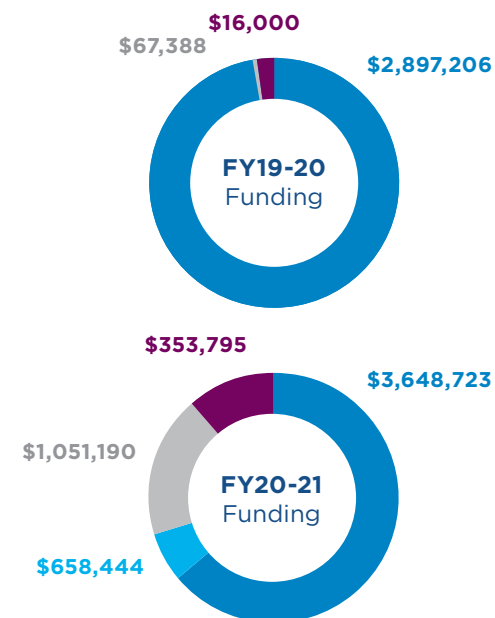
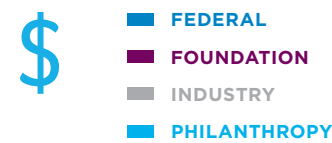
Two major recent developments in research have been the recruitment of Dr. Joji Fujisaki to the the faculty of the Center for Inflammation Research and the formation of the Sadhguru Center for a Conscious Planet.

Dr. Fujisaki studies fundamental signaling pathways that afford stem cell protection. He and colleagues have noted that hematopoietic stem cell niches accommodate distinctly activated immunosuppressive T cells. These regulatory T cells provide an immunological sanctuary for normal and transplanted stem cells, but also protect malignant stem cells from immune destruction. The goal of his research program is to develop new treatment approaches to manipulate immune privilege within the niche to improve outcomes of bone marrow transplantation, injury and malignancies.

Under the direction of Dr. Bala Subramaniam, the Sadhguru Center was established by a generous private donation. The newly established center aims to integrate medical and contemplative sciences to improve brain health and general well-being. The goal is to conduct research that employs both clinical and mindfulness-based interventions, such as multimodal intraoperative general anesthesia and opioid-sparing pain control in the postoperative period to improve post-operative outcomes, particularly related to the cognitive decline and delirium that often occur in aged patients.



## Funding by the Numbers

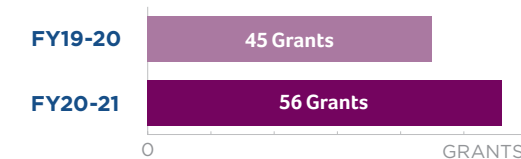


## Vision and Current Research

The major vision of our group is to become one of the world’s innovative and preeminent hospital-based research departments in the areas of anesthesia, critical care and perioperative medicine, inclusive of ongoing pain and inflammation research, by 2025. This will involve planning, designing and conducting innovative basic research with Federal funding and support from foundations and other resources. The ultimate goal is to make a positive impact on clinical outcomes in critical care and perioperative medicine by implementing translational and clinical studies to promote superlative perioperative care, pain management and control of inflammation.

Research is conducted by internationally renowned and collaborative faculty in the Burstein, Levy, Talmor, Robson-Longhi-Fujisaki, Eikermann, Mahmood-Matyal, Shaefi and Subramaniam labs. Clinical translational work is facilitated by the Center for Anesthesia Research Excellence (CARE), which serves as departmental resource to help department members conduct successful clinical research under the guidance of Dr. Max Schaefer, Dr. Balachundhar Subramaniam, Dr. Alexander Shtifman, Ms. Valerie Banner-Goodspeed and colleagues.

Dr. John Mitchell took over the teaching portfolio from Dr. Stephanie Jones, who left to chair Anesthesia at Albany Medical College. Dr. Mitchell then established CERTAIN, the Center for Education Research,





Technology and Innovation, to reinvigorate this area. Dr. Mitchell, along with Dr. Sara Neves and Dr. Cullen Jackson, and affiliated colleagues, will continue to foster education by coordinating the training of the next generation of anesthesiologists, physician scientists and researchers in areas of basic and clinical research.

Important contributions have been made in resident research in conjunction with CARE by Dr. Brian O’Gara. As an example, the Loring Scholar/Clinical Scientist Research Track was formed as a five-year residency track that recruits up-and-coming clinician-scientists and is designed to provide a pipeline of dedicated scholars in the field of anesthesia. During the proposed five-year residency training, Loring scholars will have 18 months dedicated to their research projects. This venture has met with early success.

#### List of Loring Scholars:

David Melton, MD, PhD (mentored by Dr. Simon Robson)  
 Amnon Berger, MD, PhD (mentored by Dr. Max Schaefer)  
 Heba Naseem, MD (mentored by Dr. Shahzad Shaefi)  
 Steven Woloszynek, MD, PhD (mentored by Dr. Andrew Beam)  
 Peter Santer, MD, PhD (proposed mentor Dr. Max Schaefer)

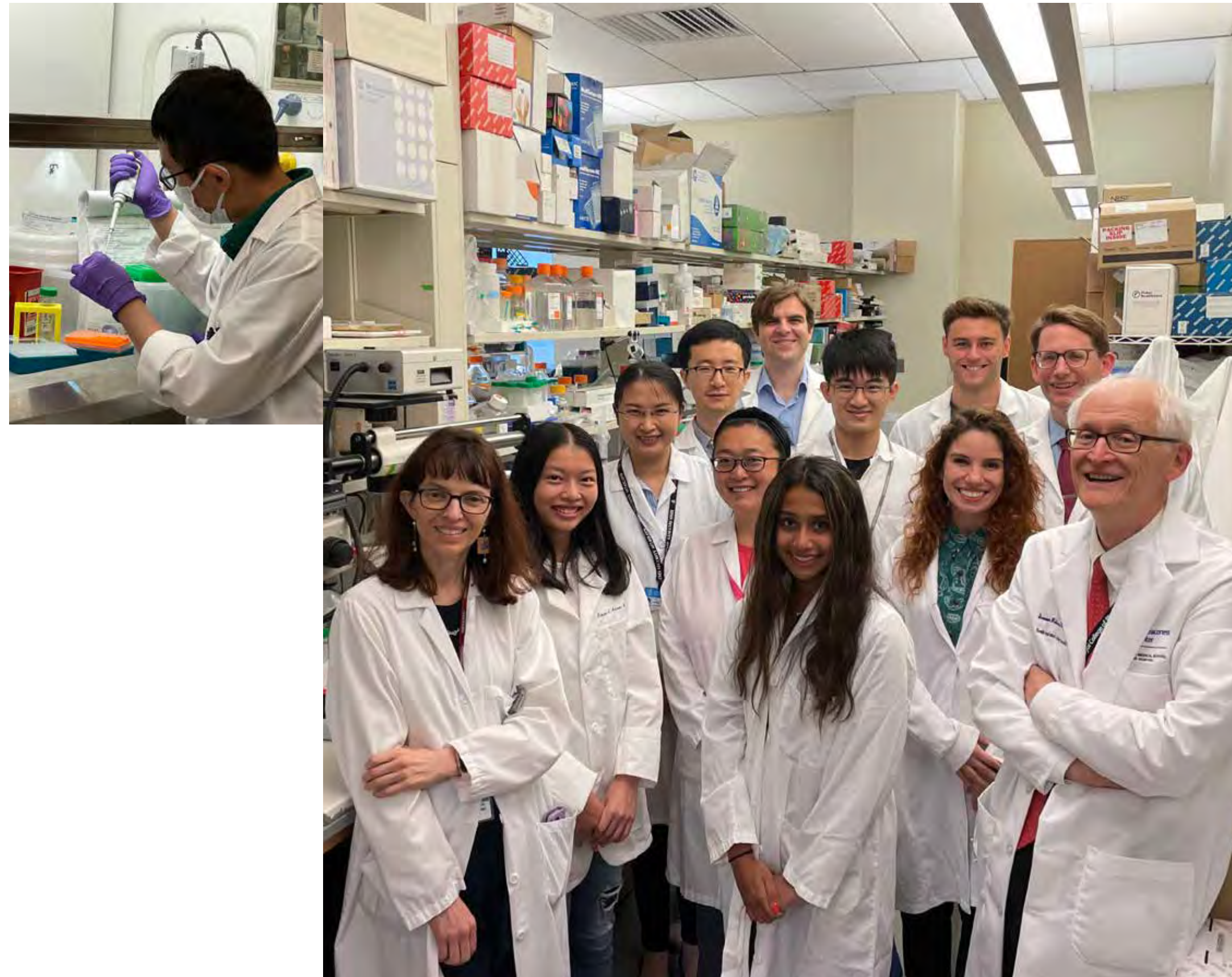
### A Legacy of Innovation



Building on its major legacy of innovative discovery, the Department of Anesthesia Research Programs provide key insights into anesthesia outcomes, critical care and pain management in the setting of surgery, postoperative care and disease. The vision of departmental leadership has been to support all researchers from idea generation through study completion, dissemination of information and publication. The ambition is to promote collaborations between clinical and research groups to optimize research outcomes, increase quality mentorship and promote diversity in the next generations of researchers and clinical scientists.

The department was awarded 44 grants totaling \$3.6 million during the 2020 academic year, and 51 grants totaling \$5.746 million during the 2021 academic year. The majority of the grants were from the National Institutes of Health (NIH) and the Department of Defense (DoD). Other funding sources include foundations, industry, BIDMC institutional grants and private donations.

Consistent with this goal, departmental faculty and trainees are actively involved in a wide array of ongoing clinical and laboratory research projects. Research in the department is internationally recognized for its contributions to experimental neurosciences, with a focus on mechanisms of anesthesia, pain and headache as well as clinical research in cardiovascular pathophysiology and delirium, purinergic signaling and inflammation. The department is developing future leaders in research through mentorship, intensive research training and education.





# Headache and Pain Research Center



**Rami Burstein, PhD**  
Vice Chair, Neuroscience  
John Hedley-Whyte Professor of Anaesthesia

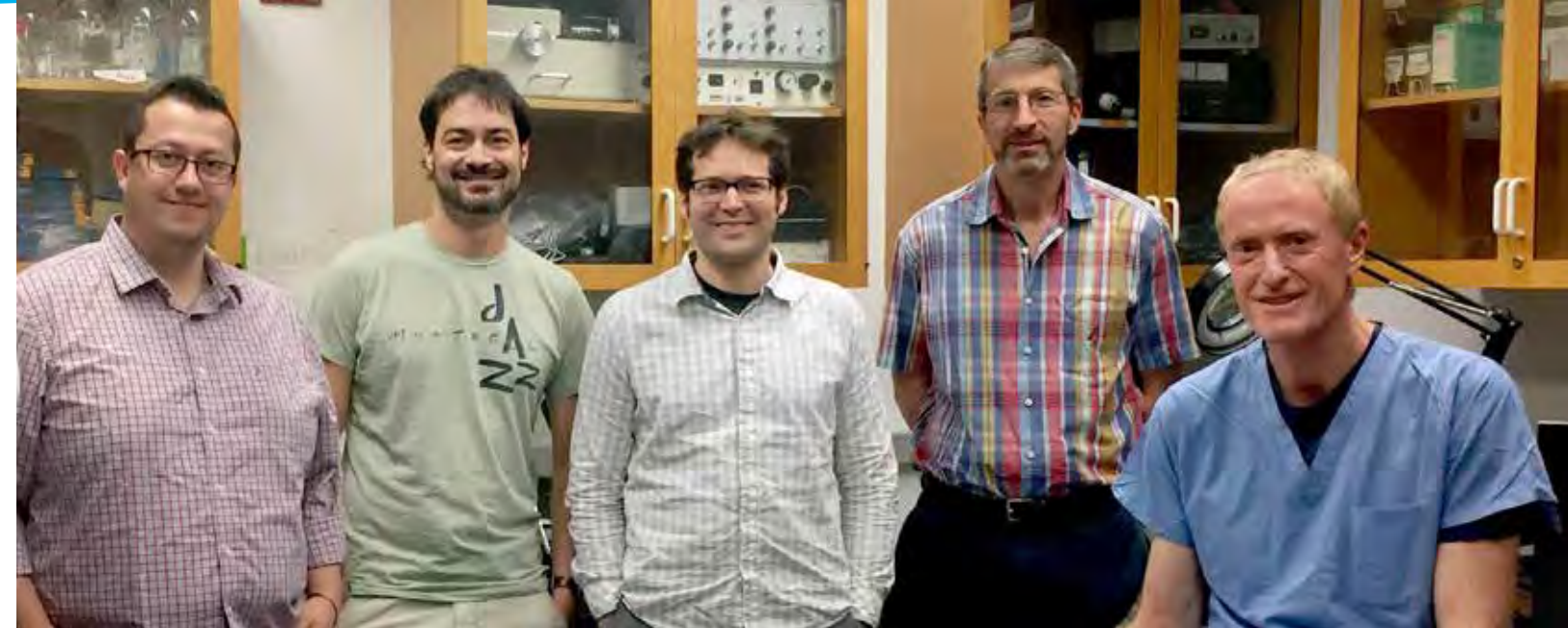
“Instinct, memory, imagination, and understanding will define the mind of a good scientist, and repeatability, reliability, accuracy, consistency and objectivity define the values of good science.”  
—Rami Burstein, PhD

## Translation Research in the Burstein Lab and Ashina Headache Clinic

We are a group of scientists and clinicians dedicated to easing the burden of migraine and tension-type headache by unraveling their many pathophysiologies and inventing novel therapeutic approaches for prevention and termination of attacks. Our group conceives, designs and executes parallel clinical and pre-clinical studies that define the power of true reverse translation (i.e., bedside to bench) research in headache medicine. We also combine molecular, genetic, epigenetic, cellular, immunological, anatomical, physiological, and behavioral techniques to study animal models of migraine with functional imaging, electrophysiological measurements, genomic and proteomic expression, and psychophysical assessments to define, prioritize and address clinically relevant questions about disease pathophysiology and mechanisms of action of a variety of migraine drugs.

**Basic research on headache:** Our research focuses on the pathophysiology of neural pathways that underlie migraine and tension-type headache and their modulation by molecules with potential therapeutic effects. These studies are conducted in collaboration with Drs. Rodrigo Noseda, Andrew Strassman, Aaron Schain and Agustin Melo Carrillo. Since 2019, basic research in the lab has attempted to determine:

- how migraine headache begins by studying neuronal, inflammatory, environmental, and behavioral triggers and their effects on the trigeminovascular system,
- the glymphatic system's role in cortical functioning and wellness,
- macrophage and dendritic cell roles in the initiation of the headache phase of migraine,
- the crosstalk between migraine and sleep,
- how post-ictal headache begins and ends after focal and generalized seizure,
- the mechanism by which aura induces activation along pain pathways underlying migraine headache,
- how light exacerbates migraine headache,
- green light's role in brain modulation during migraine, epileptic seizure and sleep,
- the thalamus' role in migraine and the way by which it transforms different colors of light into pain,
- the hypothalamus' role in migraine and the many ways by which it generates negative emotions and a variety of sympathetic, parasympathetic, physiological and endocrine changes during migraine,



### Center Research Groups:

**Rami Burstein, PhD**  
Vice Chair, Neuroscience  
John Hedley-Whyte Professor of Anaesthesia

**Dan Levy, PhD, MSc**  
Associate Professor of Anaesthesia

**Sait Ashina, MD, FAHS**  
Director, Comprehensive Headache Center  
Assistant Professor of Anaesthesia  
Assistant Professor of Neurology

### Burstein/Ashina Team Members:

**Andrew Strassman, PhD**  
Associate Professor of Anaesthesia

**Rodrigo Noseda, PhD**  
Assistant Professor of Anaesthesia

**Aaron Schain, PhD**  
Instructor in Anesthesia

**Agustin Melo Carrillo, MD, PhD**  
Instructor in Anesthesia

**Yadira Flores Montanez, MD**  
Instructor in Anesthesia and Neurology

**Ajayi Toluwanimi, BA**  
Clinical Research Assistant/Coordinator

**Shaelah Huntington, BA**  
Clinical Research Assistant/Coordinator

### Levy Team Members:

**Jun Zhao, PhD**  
Instructor in Anaesthesia

**Andrew Blaeser, PhD**  
Post-Doctoral Fellow

**Simone Carneiro-Nascimento, PhD**  
Post-Doctoral Fellow

- the intracranial origin of extracranial pain and the extracranial origin of intracranial pain,
- the cerebellum and what role it plays in occipital headache, vestibular migraine, vertigo, dizziness, motion sickness and potentially vomiting,
- the mechanisms of action of Botox, and
- the mechanism of action of calcitonin gene-related peptide (CGRP) monoclonal antibodies.



**Sait Ashina, MD, FAHS**  
Director, Comprehensive Headache Center  
Assistant Professor of Anaesthesia  
Assistant Professor of Neurology

### Clinical research on headache:

To ensure that our basic research program is relevant to the clinical condition of migraine in patients, we also conduct translational studies in the Clinical Research Center and at the Comprehensive Headache Clinic. Our clinical studies focus on:

- the multiple aspects of photophobia in migraine patients,
- the distinction between the migraine eye and the non-migraine eye,
- the distinction between the migraine brain and the non-migraine brain,
- green-light effects on headache and affect,
- role of inflammatory cells, inflammatory pathways and inflammatory genes in occipital headache and occipital neuralgia,
- mechanisms of vestibular migraine and its association with tenderness of neck muscles,
- identification of the most-effective ways to terminate status migrainosus,
- therapeutic and physiological effects of celecoxib, a liquid COX-2 inhibitor,



## Rising Stars: Junior Scientists in the Burstein Lab



**Aaron Schain, PhD** received his PhD from Northwestern University and completed a postdoctoral fellowship at Yale University.

As a postdoctoral fellow at Yale, I continued to pursue *in vivo* imaging of meningeal

immune cells in the context of meningitis and multiple sclerosis. There, I also developed a new technique for the *in vivo* imaging of myelin that requires no dyes, labels or special equipment besides a confocal microscope. This revolutionary finding made it easier for researchers to study myelin and led to a publication in *Nature Medicine* and a patent application.

Since joining Dr. Rami Burstein's group, my work has focused on the connection between migraine aura and head pain, with a major emphasis on the role of inflammatory processes in the production of migraine pain. With Dr. Burstein, we have studied the behavior of immune cells, blood vessels, and plasma protein extravasation in animal models of migraine. We look at macrophages and dendritic cells (both immune cells) inside and outside the blood-brain barrier in live mice, and watch as they change and become activated by migraine. With *in vivo* imaging, we can also see how blood vessels dilate and constrict in response to our migraine model, and how bits of blood plasma can escape into the dura. In addition, we have discovered an exciting new connection between migraine aura and the brain's glymphatic system, a network of paravascular tunnels that mediate the outflow of brain waste products. This link may implicate migraine in changes in cortical health and could provide a link between migraine and waste-clearance-related diseases like Alzheimer's disease.

In order to study these topics, we rely on the insights that can be gained from watching cells as they change morphologically in live mice using multiphoton microscopy. This type of microscopy allows us to make observations that are otherwise impossible in fixed tissue, and is key for the dynamic nature of these tissues.

- identification of responders to treating migraine with CGRP monoclonal antibodies, a new class of migraine prophylactics,
- consequences of repeated migraine attacks on brain areas involved in pain modulation and affective and cognitive functions,
- mechanisms of post-concussion headache in adolescents, and
- the enigma of how peripherally acting drugs that are too large to cross the blood-brain barrier and enter the brain affect central nervous system functions.

These ongoing studies are conducted in collaboration with Drs. Sait Ashina and Yadira Flores Montanez; David Borsook (Boston Children's Hospital); William Austin and Lisa Geferer (MGH Plastic Surgery); and Brian Grossberg (Hartford Headache Center).

### Burstein Lab Federal Grants

Title: Photophobia During Migraine: Sensory, Autonomic and Emotional Responses to Light  
Sponsoring agency: National Institute of Neurological Disorders and Stroke, NIH  
Dr. Rami Burstein (PI)

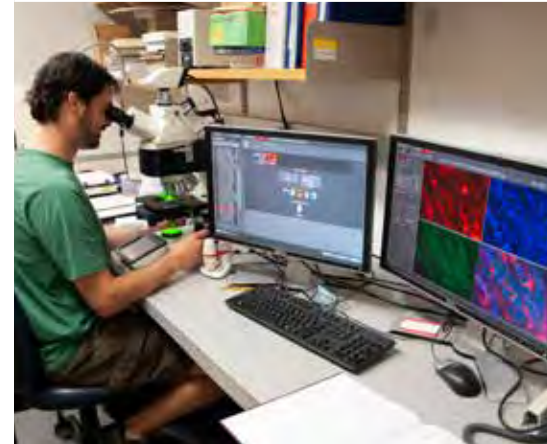
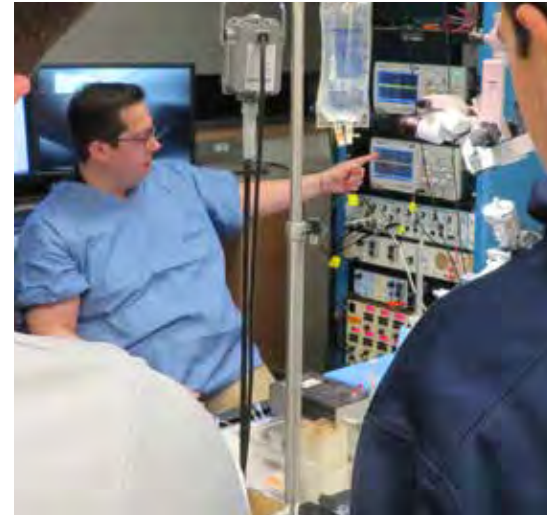
Title: Post-Traumatic Headache in Children: Alterations of Brain Function, Blood Flow and Inflammatory Processes  
Sponsoring agency: National Institute of Neurological Disorders and Stroke  
Dr. Rami Burstein (Co-I)

Title: Cortical Mechanisms of Headache: Beyond CSD  
Sponsoring agency: National Institute of Neurological Disorders and Stroke, NIH  
Dr. Rami Burstein (PI)

Title: Defining the Role of Descending Pain Modulation and Reward-Aversion Processes Towards the Development of Chronic Pain in Endometriosis  
Sponsoring agency: US Army  
Dr. Rami Burstein (Co-I)

Title: Pathophysiology of Occipital Migraine  
Sponsoring agency: NIH  
Dr. Rodrigo Nosedá (PI)

Title: Characterization of Sleep Behavior in a Rodent Model of Headache  
Sponsoring agency: NIH  
Dr. Andrew Strassman (PI)

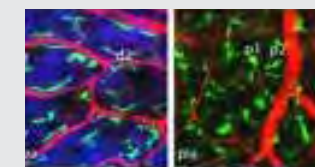


**Agustin Melo Carrillo, MD, PhD** graduated from medical school in 2009 from La Salle University in Mexico and completed his PhD in Biomedical Sciences from the National Autonomous University of Mexico.



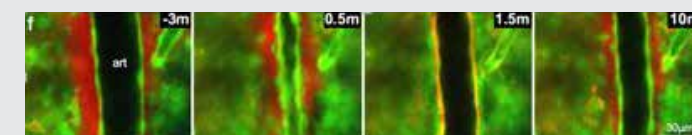
My thesis work was developing a reliable behavioral animal model for migraine. As in most other fields of medicine, the improvement of headache therapy depends on reliable animal models that can predict which drug will or will not be effective in human subjects. As a result of my work, I published the first animal model of spontaneous behavior related to headache and was awarded a joint scholarship from the Mexican and French government. The goal of the scholarship was for me to join a laboratory in France and learn new techniques that I could use as part of my research. I joined the laboratory of Dr. Luis Villanueva in the Center of Psychiatry and Neurosciences in Paris for six months and deepened my understanding and ability to perform behavioral experiments as well as some basic electrophysiology.

I joined the Department of Anesthesiology, Critical Care and Pain Medicine in 2014 to work in Dr. Burstein's and Dr. Strassman's laboratories. After three years as a post-doc, I have developed three lines of research. The first focuses on improving the reliability of animal models of migraine, which is work I started in my PhD training. I continue to develop better ways to monitor behavioral, physiological and anatomical responses to stimulation that are likely to induce intracranial pain using a variety of techniques. The second focuses on the relationship between epilepsy and headache. By using electrophysiological techniques, I pioneered a novel technical and conceptual approach to induce focal and generalized seizures and determine how these seizures activate peripheral and central neurons that process pain signals originating in the meninges. These studies led my group to a new understanding of post-ictal and ictal headaches and the relationship between epilepsy and migraine, as described in a recent publication. The third focuses on the CGRP role in migraine and the mechanisms by which CGRP monoclonal antibodies prevent chronic migraine. A novel generation of anti-migraine drugs called CGRP monoclonal antibodies were developed and recently approved by the FDA. In an effort to understand how a drug that does not cross the blood-brain barrier prevents migraine, my work in Dr. Burstein's laboratory paved the way for a novel understanding of the mechanisms of action of this class of drugs. It also contributed to a new understanding of the relative contribution that different classes of nociceptors and central nociceptive neurons play in the perception of pain and headache.



◀ Macrophages in the dura and pia of a mouse with GFP expressed under the CX3CR1 promoter.

▼ Glymphatic space (red) closes during CSD, the neural correlate of migraine aura.





### Burstein Lab Pre-Clinical Industry Grants

Title: Botulinum Toxin Mechanism of Action in Migraine Headache  
Sponsoring agency: Allergan  
Dr. Rami Burstein (PI)

Title: Novel Concepts for BoNT-A Mechanisms of Action: Role in Altering the Molecular Environment in Which Pain Fibers Exist (pre-clinical)  
Sponsoring agency: Allergan  
Dr. Rami Burstein (PI)

Title: Atogepant Small Molecule CGRP Antagonism Mechanisms of Action in Migraine Prevention  
Sponsoring agency: Allergan  
Dr. Rami Burstein (PI)

Title: OnabotulinumtoxinA Mechanisms of Action in Preventing Migraine Aura Headaches  
Sponsoring agency: Allergan  
Dr. Rami Burstein (PI)

Title: Efficacy of Combination Therapy with OnabotulinumtoxinA and Atogepant in Preventing Activation of the Trigeminovascular Pathway  
Sponsoring agency: Allergan  
Dr. Rami Burstein (PI)

Title: Mechanisms of Action of TEV-48125 Anti-Calcitonin Gene-Related Peptide (CGRP)  
Sponsoring agency: Teva  
Dr. Rami Burstein (PI)

Title: Mechanisms of Action of TEV-48125 Anti-Calcitonin Gene-Related Peptide (CGRP) Monoclonal Antibody (mAB)—Grant 2, Environmental  
Sponsoring agency: Teva  
Dr. Rami Burstein (PI)

Title: Mechanisms of Action of TEV-48125 Anti-Calcitonin Gene-Related Peptide (CGRP) Monoclonal Antibody (mAB)—Grant 3, Male vs. Female  
Sponsoring agency: Teva  
Dr. Rami Burstein (PI)

Title: Mechanisms of Action of TEV-48125 Anti-Calcitonin Gene-Related Peptide (CGRP) Monoclonal Antibody (mAB)—Grant 4, Activation by CGRP  
Sponsoring agency: Teva  
Dr. Rami Burstein (PI)

Title: Mechanisms of Action of TEV-48125 Anti-Calcitonin Gene-Related Peptide (CGRP) Monoclonal Antibody (mAB)—Grant 5, Effects on Post-Ictal Headache  
Sponsoring agency: Teva  
Dr. Rami Burstein (PI)

Title: Mechanisms of Action of TEV-48125 Anti-Calcitonin Gene-Related Peptide (CGRP) Monoclonal Antibody (mAB)—Grant 6, Effects on Immune Cells and the Glymphatic System  
Sponsoring agency: Teva  
Dr. Rami Burstein (PI)

Title: Novel Concepts for BoNT-A Mechanisms of Action: Role in Altering the Molecular Environment in Which Pain Fibers Exist  
Sponsoring agency: Allergan  
Dr. Rami Burstein (Co-PI), Dr. Sait Ashina (Co-PI)

Title: Novel Insight into Migraine Pathophysiology and Galcanezumab Mechanisms of Action  
Sponsoring agency: Eli-Lilly  
Dr. Rami Burstein (Co-PI), Dr. Sait Ashina (Co-PI)

Title: Fremanezumab, Migraine and Sleep  
Sponsoring agency: Teva  
Dr. Rami Burstein (Co-PI), Dr. Sait Ashina (Co-PI)

Title: A Randomized, Multicenter, Double-Blind, Parallel, Sham-Controlled Study of Non-Invasive Vagus Nerve Stimulation (nVNS) for the Prevention of Migraines (PREMIUM II)  
Funded by: electroCore  
Dr. Sait Ashina (Site PI)

Title: A Phase 3, Multicenter, Randomized, Double-Blind, Placebo-Controlled, Parallel-Group Study to Evaluation the Efficacy, Safety, and Tolerability of Atogepant for the Prevention of Chronic Migraine (PROGRESS)  
Sponsoring agency: AbbVie  
Dr. Sait Ashina (Site PI)

### Burstein Group Significant Publications

Melo-Carrillo A., Schain, AJ, Strassman AM, Burstein R. **Activation of Peripheral and Central Trigeminovascular Neurons by Seizure: Implications for Ictal and Postictal Headache.** *J. Neurosci.* 2020. PMID: 32527981

Noseda R, Melo-Carrillo A, Nir RR, Strassman AM, Burstein R. **Non-Trigeminal Nociceptive Innervation of the Posterior Dura: Implications to Occipital Headache.** *J. Neurosci.* 2019. PMID 30622169

Schain AJ, Melo-Carrillo A, Stratton J, Strassman AM, Burstein R. **CSD-Induced Arterial Dilatation and Plasma Protein Extravasation Are Unaffected by Fremanezumab: Implications for CGRP's Role in Migraine with Aura.** *J. Neurosci.* 2019. PMID 31127003

Bernstein C, Nir RR, Noseda R, Fulton AB, Huntington S, Lee AJ, Bertisch SM, Hovaguimian A, Buettner C, Borsook D, Burstein R. **The Migraine Eye: Distinct Rod-Driven Retinal Pathways' Response to Dim Light Challenges the Visual Cortex Hyperexcitability Theory.** *Pain.* 2019. PMID 30376534



Melo-Carrillo A, Strassman AM, Schain AJ, Broide RS, Cai BB, Rhaume C, Brideau-Andersen AD, Ashina S., Flores-Montanez Y, Brin MF, Burstein R. **OnabotulinumtoxinA Affects Cortical Recovery Period but Not Occurrence or Propagation of Cortical Spreading Depression in Rats with Compromised Blood Brain Barrier.** *Pain.* 2021. (in press)

Schain AJ, Melo-Carrillo A, Ashina S, Strassman AM, Burstein R. **Celecoxib Reduces CSD-Induced Macrophage Activation and Dilatation of Dural but Not Pial Arteries in Rodents: Implications for Mechanism of Action in Terminating Migraine Attacks.** *Pain.* 2020. PMID: 31895267



### Ashina Group Significant Publications

Ashina M, Katsarava Z, Do TP, Buse DC, Pozo-Rosich P, Özge A, Krymchantowski AV, Lebedeva ER, Ravishankar K, Yu S, Sacco S, Ashina S, Younis S, Steiner TJ, Lipton RB. **Migraine: Epidemiology and Systems of Care.** *Lancet.* 2021. PMID: 33773613

Ashina S, Buse DC, Bjorner JB, Bendtsen L; Lyngberg AC, Jensen R, Lipton RB. **Health-Related Quality of Life in Tension-Type Headache: A Population-Based Study.** *Scand. J. Pain.* 2021. PMID: 33544560

Ashina S, Bentivegna E, Martelletti P, Eikermann-Haerter K. **Structural and**

**Functional Brain Changes in Migraine.** *Pain Ther.* 2021. PMID: 33594593

Ashina S, Mitsikostas DD, Lee MJ, Yamani N, Wang SJ, Messina R, Ashina H, Buse DC, Pozo-Rosich P, Jensen RH, Diener HC, Lipton RB. **Tension-Type Headache.** *Nat. Rev. Dis. Primers.* 2021. PMID: 33767185

Iljazi A, Ashina H, Al-Khazali HM, Lipton RB, Ashina M, Schytz HW, Ashina S. **Post-Traumatic Stress Disorder After Traumatic Brain Injury—A Systematic Review and Meta-Analysis.** *Neurol. Sci.* 2020. PMID: 32415640

Larsen EL, Ashina H, Iljazi A, Al-Khazali HM, Seem K, Ashina M, Ashina S, Schytz HW. **Acute and Preventive Pharmacological Treatment of Post-Traumatic Headache: A Systematic Review.** *J. Headache Pain.* 2019. PMID: 31638888

Silberstein SD, Cohen JM, Seminerio MJ, Yang R, Ashina S, Katsarava Z. **The Impact of Fremanezumab on Medication Overuse in Patients with Chronic Migraine: Subgroup Analysis of the HALO CM Study.** *J. Headache Pain.* 2020. PMID: 32958075





**Dan Levy, PhD, MSc**  
Associate Professor of Anaesthesia

### Basic Research in the Levy Lab

Migraine is one of the leading causes of disability worldwide, and the incomplete understanding of its pathogenesis has limited the development of effective treatments. The Levy laboratory continues to conduct *in vivo* research on mechanisms underlying the triggering of migraine headache. We also study mechanisms of headaches that arise following a concussion (post-traumatic headache).

Our research employs extracellular single-unit electrophysiology and two-photon calcium imaging to study changes in the activity and sensitivity of trigeminal meningeal afferents. The lab also utilizes various methods to assess headache-related metabolic changes in the cortex, including changes in cerebral blood flow, oxygen tension and ATP release. In addition, various behavioral models related to headache are employed, including testing of facial allodynia, facial grimacing, open-field activity and place-preference paradigms. In the last two years, research in the Levy lab continued to decipher meningeal and cortical factors that contribute to the persistent activation and sensitization of meningeal nociceptors in response to cortical spreading depression with a focus on the role of astroglia, the most abundant non-neural cells in the cortex. We continued to study the mechanisms of post-traumatic headache and developed a novel rat model that allowed us to test the role of CGRP and mast cells. All electrophysiological studies were conducted by Dr. Jun Zhao. Studies related to post-traumatic headache were conducted by Dr. Dara Bree, who recently left the lab to join Cygnal Therapeutics. Dr. Andrew Blaeser has been working on MATLAB coding to analyze calcium-imaging data of meningeal afferents and astrocytes in collaboration with Dr. Mark Andermann in the BIDMC Department of Endocrinology.

Our lab also welcomed a new post-doctoral fellow, Dr. Simone Carneiro-Nascimento, in March 2020. During 2019-2020, the Levy lab has published seven papers (six basic research and one invited review). In 2019, the Levy lab also received an award from the International Headache Society for the best headache research paper published in *Cephalalgia* during the last two years.

“Curiosity killed the cat, but satisfaction brought it back.”



#### Levy Lab Grants

Title: Mechanisms of CSD-Evoked Persistent Activation of Meningeal Nociceptors

Funded by: National Institute of Neurological Disorders and Stroke  
Dr. Dan Levy (PI)

Title: Peripheral Mechanisms of Post-Traumatic Headache

Funded by: National Institute of Neurological Disorders and Stroke  
Dr. Dan Levy (PI)

Title: Chronic Two-Photon Calcium Imaging of Intracranial Meningeal Afferents in Awake-Behaving Mice  
Funded by: National Institute of Neurological Disorders and Stroke  
Dr. Dan Levy (PI)

Title: The Role of CGRP in Chronic Post-Traumatic Headache  
Funded by: Teva  
Dr. Dan Levy (PI)

Title: Consequences of Early-Life Stress on Alcohol Intake in Later Life and the Susceptibility to Migraine Headache and Self-Medication  
Funded by: Brain and Behavior Research Foundation, NASRAD grant  
Dr. Dan Levy, mentoring PI, NARSAD Young Investigator Award Winner  
Dr. Kate McDonnell-Dowling

Title: Cortical-Meningeal Interactions Underlying Migraine Headache  
Funded by: National Institute of Neurological Disorders and Stroke  
Dr. Dan Levy (PI)

#### Levy Lab Significant Publications

Bree D, Levy D. **Intact Mast Cell Content During Mild Head Injury is Required for Development of Latent Pain Sensitization: Implications for Mechanisms Underlying Post-Traumatic Headache.** *Pain*. 2019. PMID: 30624345

Bree D, MacKenzie K, Stratton J, Levy D. **Enhanced Post-Traumatic Headache-Like Behaviors and Diminished Contribution of Peripheral CGRP in Female Rats Following a Mild Closed Head Injury.** *Cephalalgia*. 2020. PMID: 32077327

Bree D, Stratton J, Levy D. **Increased Severity of Closed Head Injury or Repetitive Sub-Concussive Head Impacts Enhances Post-Traumatic Headache-Like Behaviors in a Rat Model.** *Cephalalgia*. 2020. PMID: 32600065

Bader M, Bree D, Hadar R, Nemerovski A, Tam J, Levy D, Pick CG, Gabet Y. **Bone Anabolic Response in the Calvaria Following Mild Traumatic Brain Injury is Mediated by the Cannabinoid-1 Receptor.** *Sci. Rep.* 2019. PMID: 31700010

Levy D, Gruener H, Riabinin M, Feingold Y, Schreiber S, Pick CG, Defrin R. **Different Clinical Phenotypes of Persistent Post-Traumatic Headache Exhibit Distinct Sensory Profiles.** *Cephalalgia*. 2020. PMID: 31847569

Levy D, Labastida-Ramirez A, MaassenVanDenBrink A. **Current Understanding of Meningeal and Cerebral Vascular Function Underlying Migraine Headache.** *Cephalalgia*. 2019. PMID: 29929378

Zhao J, Blaeser AS, Levy D. 2021. **Astrocytes Mediate Migraine-Related Intracranial Meningeal Mechanical Hypersensitivity.** *Pain*. (in press)

### Levy Lab Junior Investigator

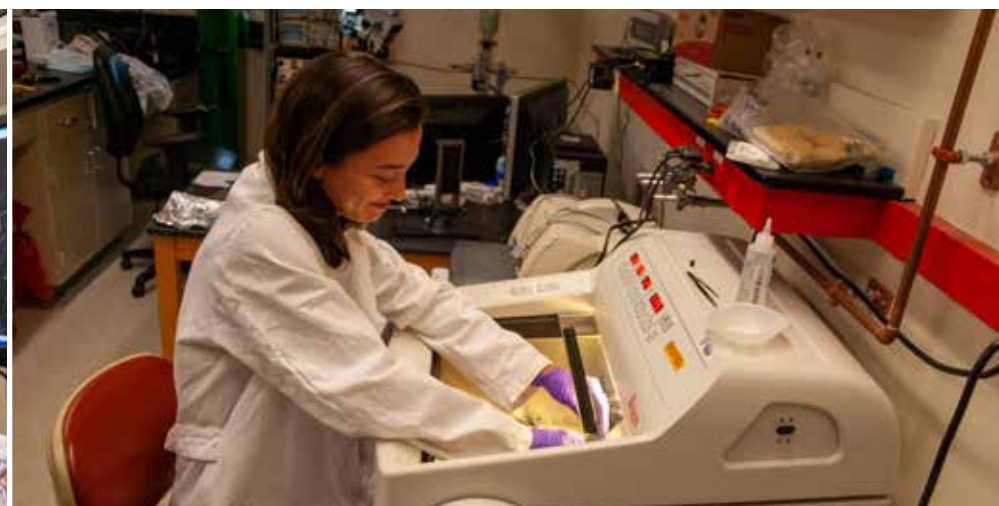
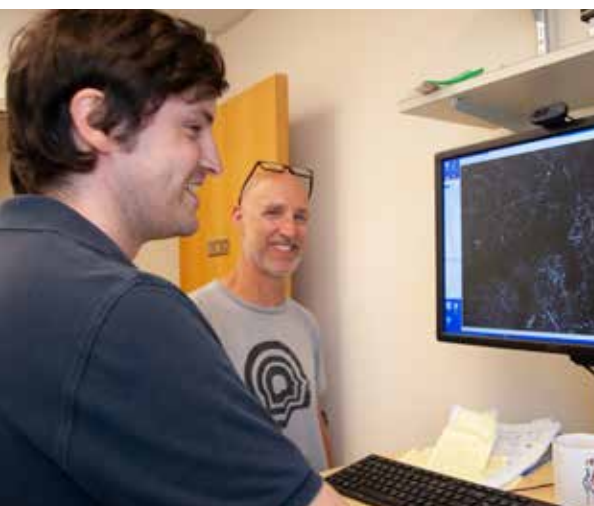
#### Jun Zhao, PhD

Dr. Zhao's work during the past several years focused on two different areas of research.



He studies the role of astrocytes in cortical spreading depression-induced headache and establishes

methods to study and analyze cortical astrocyte activity in rats using two-photon imaging. In addition, Dr. Zhao has built a website and related database to manage research data and established the website and database in the hospital server.





# Center for Inflammation Research



**Simon C. Robson, DCH, MBChB, PhD, FRCP, FAASLD**

Vice Chair, Research

Director, Center for Inflammation Research  
Joseph J. and Josephine A. Gazzola Family  
Chair in the Field of Inflammation Research  
Professor of Anaesthesia

Charlotte F. & Irving W. Rabb Distinguished  
Professor of Medicine

“From a little spark  
may burst a flame.”  
—Dante Alighieri



**Maria Serena Longhi, MD, PhD**

Co-director, Center for  
Inflammation Research  
Associate Professor of Anaesthesia

## Who we are

The Center for Inflammation Research is a group of basic scientists, immunologists and clinicians dedicated to prevention, treatment and cure of inflammatory and immune diseases by conducting innovative research into how innate immune and adaptive responses factor into the pathogenesis of disease and by developing novel therapeutic approaches. The group was recently broadened and strengthened by the recruitment of Dr. Joji Fujisaki, formerly an associate professor at Columbia University in New York.

Inflammation comprises an innate response to injury, caused by trauma, infection or alterations in cell phenotypes that is marked by vascular responses with capillary dilatation, leukocytic infiltration, redness, swelling, heat, loss of function and pain. Inflammation can be a protective mechanism initiating the elimination of noxious agents, infections and damaged or transformed malignant tissue. Damage is perpetuated when inflammation is not effectively regulated. Unlike acute inflammation, which follows a minor injury and rapidly resolves, chronic damage can occur as a result of steady, persistent levels of inflammation that can contribute to the development of disease, such as in hepatitis and inflammatory bowel disease. Unfettered inflammation can damage blood vessels and result in organ dysfunction, as in cirrhosis or stricture formation in the intestine, as well as metabolic disease, diabetes and cancer.

A major metabolite on which all life depends is ATP, which serves as the energy currency of the cell. This biochemical substance can be released at high levels from platelets or immune cells, or from apoptotic injured cells. Extracellular ATP provokes inflammation and plays a significant role

in promoting immune responses. However, ATP is converted into the nucleoside product adenosine through the expression of an enzyme CD39 on regulatory immune cells and the vasculature, as well as on certain cancer cells. This derivative adenosine blocks immune responses and promotes blood supply and healing. This is our area of interest: purinergic signaling as basic science and translational research provide the central theme of the Center for Inflammation Research. We undertake innovative work in vascular biology, immunity, immunometabolism and purinergic signaling.



**Joji Fujisaki, MD, PhD**

Co-director, Center for  
Inflammation Research  
Member of the Faculty, Medicine

## Postdoctoral Research Fellows

Luiza Abrahao-Frank, PhD  
Jonathon Graham, PhD  
Marta Vuerich, PhD  
Na Wang, MD

## Graduate Students and Researchers

Rasika Harshe, BSc, MSc  
Graduate Student and Research Associate  
Barbora Gromova, BSc, MSc  
Graduate Student  
Ahmadreza Kalbasi, BSc, MSc  
Graduate Student and Research Assistant  
Joji Fujisaki, MD, PhD  
Principal Investigator  
Maria Serena Longhi, MD, PhD  
Principal Investigator

## Affiliated Faculty and Postdoctoral Fellows

Ryosuke Ueda, MD, PhD  
Postdoctoral Research Fellow  
Moah Sohn, DVM, PhD  
Postdoctoral Research Fellow  
Simon C. Robson, MD, PhD  
Principal Investigator  
Dusan Hanidziar, MD, PhD  
Instructor in Anaesthesia  
Staff Scientist  
Jessica Cassavaugh, MD, PhD  
Instructor in Anaesthesia  
Staff Scientist  
Yan Wu Shang, PhD  
Instructor in Medicine  
Staff Scientist  
Paola de Andrade Mello, PhD  
Postdoctoral Research Fellow  
Haohai Zhang, MD, PhD  
Postdoctoral Research Fellow  
Lili Feng, MD, PhD  
Postdoctoral Research Fellow  
Shilpa Tiwari-Heckler, MD  
Postdoctoral Research Fellow  
Eva Csizmadia, BSc  
Histopathology Technologist  
Gordon Jiang, MD, PhD  
Assistant Professor of Medicine  
Maria Camila Perez, MD  
Postdoctoral Research Fellow  
David Melton, MD, PhD  
Resident, Anaesthesia  
Justin Mark Lunderberg, MD, PhD  
Resident, Anaesthesia  
Claudia Santamaria, MD, PhD  
Resident, Anaesthesia  
Shahzad Shaefi, MD, MPH  
Associate Professor of Anaesthesia  
Balachundhar Subramaniam, MD, MPH  
Professor of Anaesthesia



## What we do

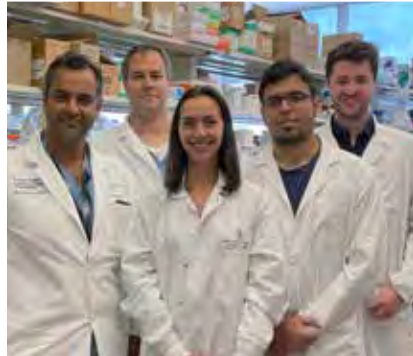
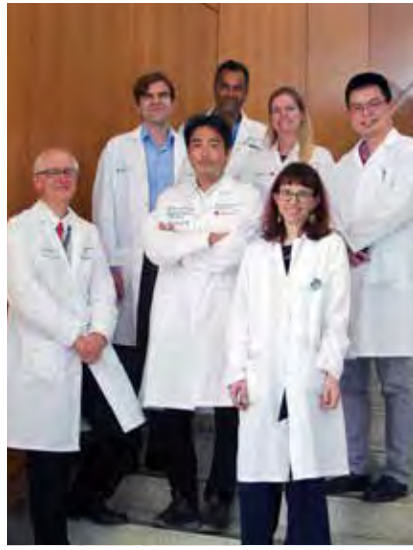


Focus over the past two decades has been on studying mammalian ectonucleotidases, which are vascular, myeloid and regulatory lymphoid-cell-expressed ectoenzymes that hydrolyze extracellular nucleotides, such as ATP and ADP, to adenosine and derivatives. CD39 and other gene family members, expressed on the vasculature and regulatory immune cells, are crucial in the maintenance of homeostasis and in the control of inflammation and immune responses in transplanted organs as well in native organs, such as the lungs and liver.

CD39 and family members are highly relevant to the control of inflammation in human disease and provide innovative therapeutic targets in inflammatory diseases and cancer. Pertinent examples include CD39 and related proteins being solubilized or coupled to biodegradable polymers/liposomes, or expressed in a transgenic manner to boost generation of adenosine. Select investigational agents may be administered systemically to ameliorate inflammatory responses, as in ischemia reperfusion injury, graft rejection and systemic inflammatory states such as those following trauma and surgery.

Purinergic signaling is also a central component of the dysregulated inflammation in cancer. Immune escape of cancer involves heightened suppressive responses to extracellular nucleotides and adenosine, which are also tightly regulated by the ectonucleotidases CD39 family members and CD73. Therefore, pharmacological blockade of CD39 and CD73, as with neutralizing antibodies or small molecules, can augment host cellular responses and alter vascular homeostasis to specifically target experimental cancers. This bolstering of immunostimulatory effects, by overcoming immune exhaustion and augmenting responses to release of ATP post-chemotherapy, has potential clinical benefits in cancer and other states of immune exhaustion.





Additional studies conducted across the center aim at investigating how CD39 interacts with other signaling pathways and how this ectoenzyme is regulated at the transcriptional and post-transcriptional level. In this regard, we are investigating the role of aryl hydrocarbon receptor signaling and hypoxia in modulating CD39 levels along with immunometabolism during chronic inflammation. Additional investigations include defining the role of CD39-specific antisense RNA in the negative regulation of this ectoenzyme.

Our studies in the settings of Crohn's disease and autoimmune liver diseases have highlighted alterations in the aryl hydrocarbon receptor signaling as well as aberrantly high levels of CD39 antisense RNA that interfere with CD39 expression and with Treg suppressive function.

We are further extending our efforts to characterize the roles of CD39 and adenosine in the particular context of stem cell protection. We have demonstrated that the hematopoietic stem cell niche accommodates distinctly activated niche Tregs. Such niche Tregs and their product, adenosine, render the stem cell niche an immunological sanctuary for normal, transplanted and malignant stem cells. We are seeking to develop new treatment approaches to manipulate such niches' immune privilege to improve the outcome of bone marrow transplantation, injury and malignancies.

### How we address the current challenges and what we plan to do

Research activities will be focused around specific identified translational research challenges addressed from conception through to clinical impact by multidisciplinary teams that include practicing clinicians; academics from basic and translational sciences; and external stakeholders, including those from biotechnology, philanthropic organizations and patients and family donors through the BIDMC Development Offices.

The center is structured around the following program areas and integrates newly formed areas of faculty development and translational clinical research contributed by colleagues within the Anesthesia Department.

#### Inflammation

- Dramatic advances in immunology over the past decades have led to better understanding and, in several instances, enhanced control of many acute and chronic inflammatory processes (as with the new developments in the immunotherapy of cancer). The plan is to develop new knowledge in the area of purinergic and innate regulation of vascular inflammatory responses, immune cell reactivity and pain.
- These studies will primarily focus on mitochondrial mediators, extracellular nucleotides, xenobiotics, oxygen and related heme oxygenase-mediated pathways.

- Expertise in inflammation exists chiefly still at the single-investigator level, though new programs are evolving in Trauma and Critical Care. By integrating across Anesthesia and other departments with design of new programs and leveraging the extensive expertise and resources in inflammation and immunology, the center will grow and then partner across Harvard, affiliated hospitals and other institutions, creating important synergies for maximum impact and funding opportunities.

#### Translational studies

- Initial focus will be on the validation of novel treatments to abrogate immune exhaustion and thereby enhance anti-pathogen (hepatitis C and others) or anti-tumor inflammatory responses. Lymphocyte exhaustion is also an important component of sepsis and chronic critical illness. Innate immune failure might predispose to development of pneumonia in mechanically ventilated patients. The plan is develop a research agenda that links and combines diverse but complementary disciplines in anesthesia to focus on detecting, diagnosing, investigating and treating disease with a desire to commercialize these discoveries with newly developing biotechnological ventures (Purinomia and Tizona) as well as evolving intellectual property at BIDMC.

#### Education

- Use of departmental-focused resources (e.g., NIH Anesthesia Center grants and T32/KL2 grants) is available for students, residents, trainees, fellows and faculty to foster education and training in biomedical research in the areas of focus within Anesthesia, Critical Care and Pain Medicine. The emphasis is on experimental models of human inflammatory disease and the application of innovative discoveries to translational studies. This effort will also use currently available resources within other departments at BIDMC, the inter-institutional T32 award and facilities at Harvard.
- The Harvard Catalyst center serves to bring together the “intellectual force, technologies, and clinical expertise of Harvard University and its affiliates and partners to reduce the burden of human illness.”

This coordinated research portfolio provides a platform for the development of training programs that cross disciplines and place the focus on innovation, discovery and translation. It will continue to develop relevant research and therefore prepare future generations of academic physicians and scientists.



**Joji Fujisaki, MD, PhD** joined the Center for Inflammation Research in 2020. His research focuses on the novel interfaces of stem cell biology with immunology. Dr. Fujisaki's group recently established

a novel understanding that the stem cell microenvironment, termed the “niche,” acts as an immunological sanctuary for normal, malignant and transplanted stem cells from immune attack and stress. The area has great significance in physiological and pathological tissue regeneration, as noted in inflammatory diseases, cancer and transplantation. Dr. Fujisaki's work is published extensively in high-impact peer reviewed journals. His addition to our center has broadened our scope and will allow us to have an even greater impact in investigating mechanisms of inflammatory and immunologic responses to treat this very prevalent category of disease. We are delighted to have Dr. Fujisaki on our team as a colleague and collaborator.



**Dusan Hanidziar, MD** is a member of our laboratory and an attending physician in the Department of Anesthesia, Critical Care and Pain Medicine at Massachusetts General

Hospital and Instructor in Anesthesia at Harvard Medical School. He is a physician scientist whose research focuses on understanding the immunobiology of hyperoxic lung injury. Dr. Hanidziar established that the evolution of hyperoxic lung injury is immune-cell-dependent. Methods to therapeutically suppress tissue-destructive elements (NKT cells) and enhance tissue-protective elements (B cells) in lung injury are currently tested in the laboratory.

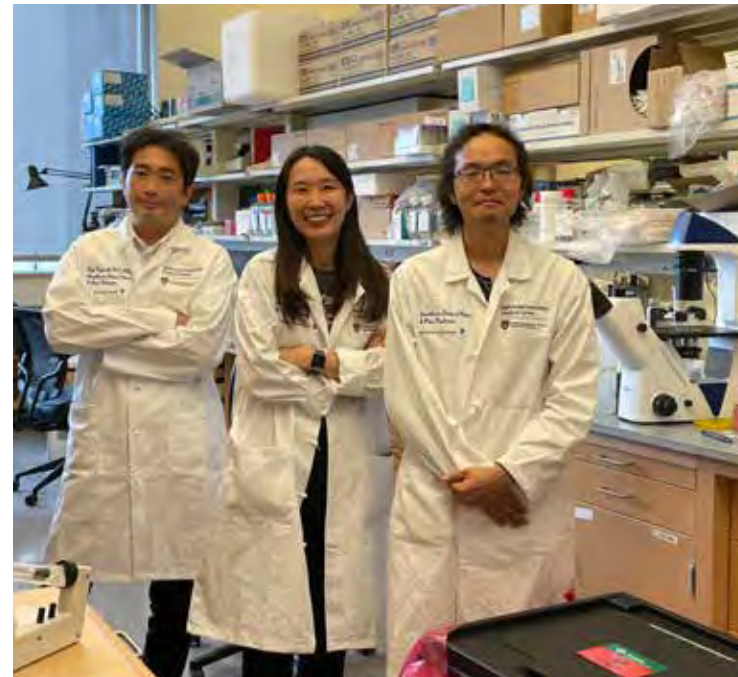


## Awards and Recognition

Simon C. Robson, MD, PhD, FRCP, received the Joseph J. and Josephine A. Gazzola Family Chair in the field of Inflammation Research. Funding for this chair was provided by a generous donor and was designated to support research pertaining to inflammation and autoimmune disorders of the liver and GI tract.

## Grants and Funding

Our group has been funded by the National Institutes of Health (NIH); Department of Defense Peer-Reviewed Cancer Research Program (DOD PCRP); National Institute of Allergy and Infectious Diseases (NIAID); National Institute of Diabetes and Digestive and Kidney Disorders (NIDDK); National Heart, Lung and Blood Institute (NHLBI); National Cancer Institute (NCI); Department of Defense Focused Research Award; and other national and international groups as well as biopharma and philanthropy.



Title: Immunomodulatory Effects of Bilirubin are Mediated through the Aryl-hydrocarbon Receptor, O<sub>2</sub> and Purinergic Pathways  
Funded by: NIH/NIDDK  
Dr. Maria Serena Longhi (PI)

Title: Alterations of Aryl-hydrocarbon Receptor (AhR) Signaling in Autoimmune Hepatitis (AIH)  
Funded by: NIH/NIDDK  
Dr. Maria Serena Longhi (PI)

Title: The Role of Aryl-hydrocarbon-Receptor (AhR) Signaling in Autoimmune Hepatitis (AIH)  
Funded by: Department of Anesthesia Seed Grant  
Dr. Maria Serena Longhi (PI)

Title: Immune Privilege of the Hematopoietic Stem Cell Niche Shields Metastatic Prostate Cancer from Immunity  
Funded by: DOD PCRP  
Dr. Joji Fujisaki (PI)

Title: Dissecting Immune Privilege of the Hematopoietic Stem Cell Niche  
Funded by: NIH NHLBI  
Dr. Joji Fujisaki (PI)

Title: Roles and Therapeutic Potential of CD150 High Niche-Associated Regulatory T Cells in Bone Marrow Injury and Engraftment  
Funded by: NIH NHLBI  
Dr. Joji Fujisaki (PI)

Title: Identification of Unique Nitric Oxide-Expressing Hematopoietic Stem Cells and their Special Vascular Niche  
Funded by: NIH NIDDK  
Dr. Joji Fujisaki (PI)

Title: Role of CD39+ Cells in the Tumor Microenvironment  
Funded by: Antigen Institute Biomedical Research  
Dr. Simon C. Robson (PI)

Title: Examining Carbon Monoxide to Treat Inflammatory Conditions Using Experimental Colitis models  
Funded by: CM NIH  
Dr. Simon C. Robson (Co-Investigator)

Title: New Driver of Fibrosis and Calcification in CAVD  
Funded by: NHLBI NIH  
Dr. Simon C. Robson (Co-Investigator)

Title: Cultivating our Base of Acceptable Liver Transplants  
Funded by: NIAID NIH  
Dr. Simon C. Robson (Co-Investigator)

Title: Unleash the Potential of Intestinal Transplantation  
Funded by: NIAID NIH  
Dr. Simon C. Robson (Co-Investigator)

Title: Directed Purinergic Signaling as Immunotherapy in Leukemia  
Funded by: NCI NIH  
Dr. Simon C. Robson (Co-PI), Dr. David Avigan (Co-PI)

Title: Evaluation of Anti-CD39 Antibodies for Enzymatic Inhibition and Functional Blocking (in vitro)  
Funded by: Tizona SRA Biotech  
Dr. Simon C. Robson (PI)

Title: DAMP-Mediated Innate Immune Failure and Pneumonia after Trauma  
Funded by: PRMRP-FPA DOD  
Dr. Simon C. Robson (Project Leader)

Title: Role of Enteric Glia in the Death of Neurons during Gut Inflammation  
Funded by: NIDDK NIH  
Dr. Simon C. Robson (Co-Investigator)

Title: Enteric Glia and Visceral Pain  
Funded by: NIDDK  
Dr. Simon C. Robson (Co-Investigator)

Title: Role of Biliverdin Reductase During Sterile Inflammation in the Liver  
Funded by: NIDDK NIH  
Dr. Simon C. Robson (Co-Investigator)

Title: Natural Killer T (NKT) Cell Mediated Tissue Injury is Modulated by CD39 in Models of Non-alcoholic Fatty Liver Disease  
Funded by: Fellowship (German Research Foundation)  
Dr. Shilpa Tiwari-Heckler (Fellow)  
Dr. Simon C. Robson (Mentor)

Title: Purinergic Modulation of NKT Cells Ameliorates Hyperoxic Lung Injury  
Funded by: NHLBI NIH  
Dr. Dusan Hanidziar (Fellow)  
Dr. Simon C. Robson (Mentor)

## Significant Publications

Badimon A, Strasburger HJ, Ayata P, Chen X, Nair A, Ikegami A, Hwang P, Chan AT, Graves SM, Uweru JO, Ledderose C, Kutlu MG, Wheeler MA, Kahan A, Ishikawa M, Wang YC, Loh YE, Jiang JX, Surmeier DJ, Robson SC, Junger WG, Sebra R, Calipari ES, Kenny PJ, Eyo UB, Colonna M, Quintana FJ, Wake H, Gradinaru V, Schaefer A. **Negative feedback control of neuronal activity by microglia.** *Nature*. 2020. PMID: 32999463

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Sandhu B, Perez Matos MC, Tran S, Singhal G, Syed I, Feldbrügge L, Mitsuhashi S, Pelletier J, Huang J, Yalcin Y, Csizmadia E, Tiwari-Heckler S, Enjoji K, Sévigny J, Maratos-Flier E, Robson SC, Jiang ZG. **Global deletion of NTPDase3 protects against diet-induced obesity by increasing basal energy metabolism.** *Metabolism*. 2021. PMID: 33631144

Vuerich M, Harshe R, Frank LA, Mukherjee S, Gromova B, Csizmadia E, Nasse IAM, Ma Y, Bonder A, Patwardhan V, Robson SC, Longhi MS. **Altered aryl-hydrocarbon-receptor signaling affects regulatory and effector cell immunity in autoimmune hepatitis.** *J Hepatol*. 2021. PMID: 32663496

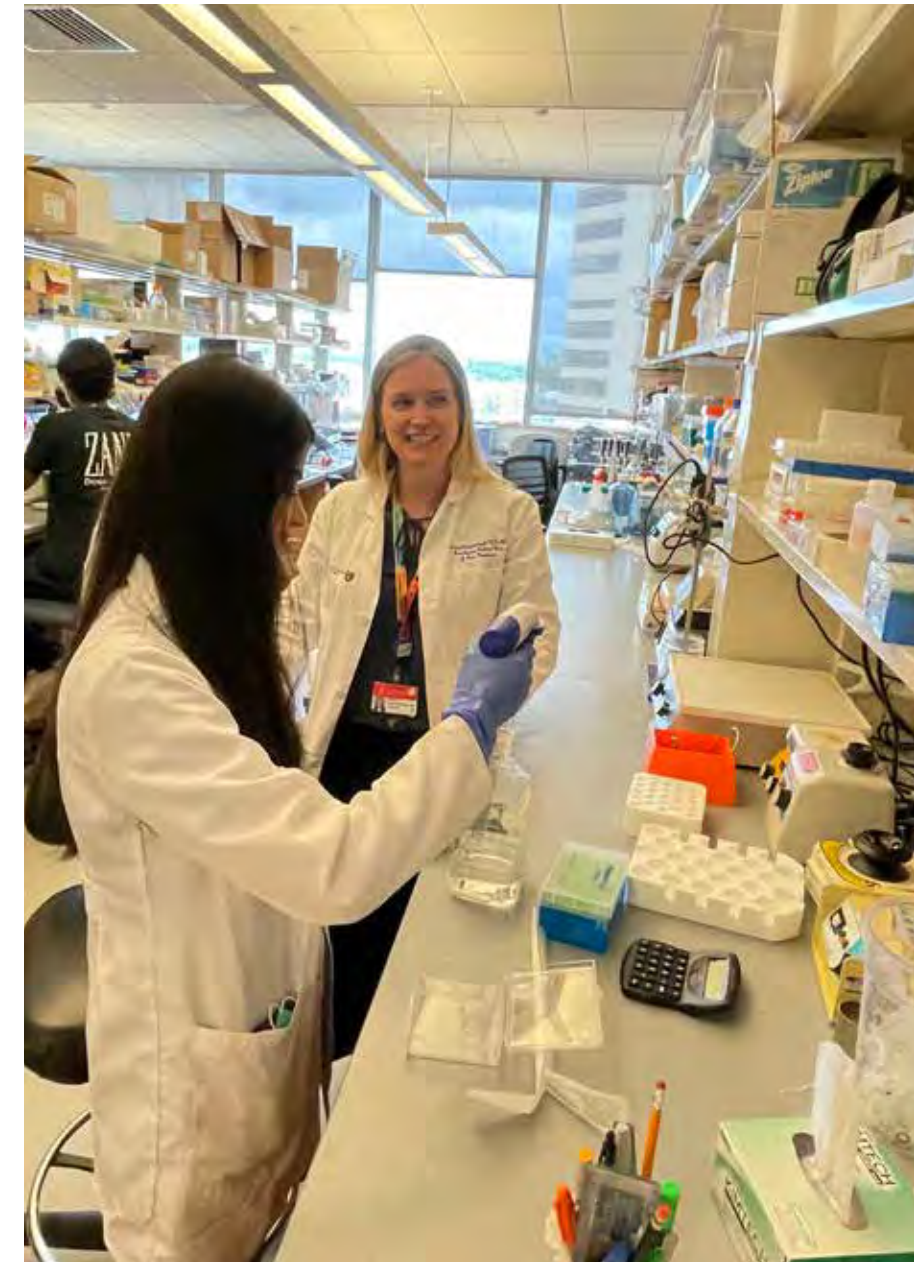
Zhong EH, Ledderose C, De Andrade Mello P, Enjoji K, Lunderberg JM, Junger W, Robson SC. **Structural and functional characterization of engineered bifunctional fusion proteins of CD39 and CD73 ectonucleotidases.** *Am J Physiol Cell Physiol*. 2021. PMID: 33052071

## Conclusion

Our mandate for the next two years is the development of basic research within the field of anesthesia focused on understanding the mechanisms of inflammation and immunobiology. We will seek synergy within other divisions and sections of the Anesthesia Department, and develop collaborations with PIs in divisions of medicine and the departments of surgery and radiology.

We will apply discoveries at the bench to the ongoing development of translational clinical studies. Lastly, we enhance teaching and education by continuing current successful models and further develop new training and fellowship programs.

These goals will be coordinated with the current resources in CARE and the newly established Sadhguru Center to further facilitate research endeavors.





# Perioperative Outcomes Lab



## Maximilian S. Schaefer, MD

Director, Thoracic Anesthesia

Director of Center for Anesthesia Research Excellence (CARE)

Assistant Professor of Anaesthesia

*(Maximilian Schaefer, MD took over the lab from Matthias Eikermann, MD, PhD, in April 2021)*

“We have the vision of improving patient outcomes after surgery and critical care based on individualized patient care strategies. Our success is based on an open-minded approach to new ideas, complemented by diverse, mutually enriching interdisciplinary collaborations on a departmental level and beyond.”

The Perioperative Outcomes Lab is a dedicated group of clinician scientists, research fellows and students working toward the common goal of improving the lives of patients who present to the hospital network following a traumatic injury or illness. The primary goal of our research is to improve outcomes of relevance to daily living and quality of life after surgery and critical care. We study increased comorbidity burden (e.g., respiratory complications, stroke and delirium) as well as patient-centered long-term outcomes (e.g., inability to live independently, readmission). Recently we expanded our research efforts to address timely research questions related to sedation in patients with COVID-19.

In order to address a broad spectrum of research, our group employs many methodologies, including retrospective and prospective observational studies as well as interventional clinical trials. A collaborative and interdisciplinary approach is the guiding principle of our research program. We have established highly granular data repositories of surgical and critical care patients, which allow us to study important interventions and outcomes. To address research questions in patients with COVID-19, we adapted existing datasets to include these patients.

## Mentorship

Mentorship and professional development of new lab members, from students to fellows, is a crucial aspect of our work. Visiting medical students and research interns are mentored by experienced fellows, who in turn receive guidance from experienced clinicians. Close communication between the principal investigator and each lab member—individually and as a group—contributes to ongoing success and development.

## Diversity, Equity and Inclusion

A central theme of our research is improving postoperative patient outcomes for all patients regardless of their gender, race, national or ethnic origin or socioeconomic backgrounds. We firmly believe in conducting inclusive research and enriching the lives of all, including those at the margins of society. As an attempt to further our goal, under our leadership, recently the Beth Israel Deaconess Medical Center (BIDMC)–Massachusetts General Hospital (MGH) Health Care Outcomes and Perioperative Equity (HOPE) initiative was founded. Our goal is to examine whether relevant disparities in surgical care exist and to identify and test strategies to eliminate them.



## Members

Philipp J. Fassbender, MD  
Assistant Professor of Anaesthesia  
Attending Anesthesiologist

Karuna Wongtangman, MD  
Research Fellow

Omid Azimaraghi, MD  
Research Fellow

Peter Santer, MD, DPhil  
Research Fellow

Aiman Suleiman, MD  
Research Fellow

Luca Wachtendorf  
Research Student

Felix Linhardt  
Research Student

Michael Blank  
Research Student

Curie Ahn  
Research Student

Tim Tartler  
Research Student

## Clinical Research

A major research focus of our group is predicting loss of the ability to live independently after surgery. This includes discharge to long-term nursing homes or skilled nursing facilities and is a frequent and devastating outcome for previously independent patients undergoing surgery. Over the last two years, we developed and validated prediction scores for this severe outcome in general surgical patients (DEPENDENSE score), cardiac patients, and elderly patients undergoing lower-extremity surgery (ADELES score, [www.adeles-score.org](http://www.adeles-score.org)). Predictors of the loss of the ability to live independently were similar across the surgical procedures: age, insurance status, sex and marital status play an important role, in addition to comorbidities and procedure-specific risk factors. In clinical practice, these scores can raise awareness among clinicians and help manage patient expectations. Ongoing research investigates the incidence of adverse discharge in different surgical procedures (e.g., aortic valve replacement) and among patients with certain comorbidities (e.g., migraine).

Other important patient-centered outcomes studied are postoperative pulmonary complications, such as pneumonia, hypoxemia or respiratory failure, and cardiovascular complications such as heart attack or stroke.

Using the department’s research data repository in conjunction with MGH data, we recently began examining racial disparities in perioperative medicine. Racial disparities in health care access, treatment and outcomes—including surgery—are well documented in the United States. Black Americans have higher rates of mortality for most of the leading causes of death and medical conditions, including diabetes mellitus and arterial hypertension, which are also more prevalent among Black Americans. This first project of the HOPE initiative will be a cornerstone on our journey toward the elimination of racial disparities in perioperative medicine.



Furthermore, our team is conducting several prospective observational and interventional clinical studies in critically ill patients. The multicenter, randomized, controlled MIDAS trial studying the effects of midodrine as an adjunct for the treatment of refractory hypotension in the ICU was successfully completed last year. Midodrine was found to have no effect on the time to discontinuation of intravenous vasopressors, much to the surprise of many intensivists who had advocated for off-label use of the drug. The resulting publication in *Intensive Care Medicine* was featured at several international meetings and led to a very active discussion within the clinical and scientific community.

Another major area of interest lies in the field of early mobilization in critically ill patients recovering from surgery. In close collaboration with ICU nurses, physical therapists and physicians, we identified optimal mobilization treatment for individual groups of patients to help improve long-term patient outcomes and ensure functional independence after severe illness. By collaborating with international experts from the United States and Europe, we were able to show that early, goal-directed mobilization in the surgical ICU helps improve patients' functional recovery to a level that enables independent living. A high level of mobilization was an independent predictor of a patient's ability to live independently after discharge. The duration of the individual treatment seemed to be equally as important, or even more important, than its maximum intensity.

Lastly, our ongoing research in critically ill patients focuses on neurocognitive impairment, sedation and neuromuscular blockade. In an industry-funded randomized controlled trial, we investigated the effects of the sleep-promoting agent suvorexant on sleep and delirium. In parallel, observational research efforts are directed toward identifying the optimal pharmacological (sedation and neuromuscular blocking agent regimens) and non-pharmacological (early mobilization, sleep hygiene) management strategies in patients who need mechanical ventilation in the ICU. In patients with acute respiratory distress syndrome, adjunctive treatment with neuromuscular-blocking-agent infusions resulted in a prolonged period of deeper sedation during mechanical ventilation, which explained effects on mortality. We also confirmed this in a cohort of COVID-19 patients, who were found to receive higher doses of hypnotics, resulting in more comatose days and higher in-hospital mortality. A high proportion of deep sedation during mechanical ventilation was further found to be dose-dependently associated with higher delirium risk after extubation.

#### SELECTED PUBLICATIONS

Althoff FC, Wachtendorf LJ, Rostin P, Santer P, Schaefer MS, Xu X, Grabitz SD, Chitilian H, Houle TT, Brat GA, Akeju O, Eikermann M. **Effects of Night Surgery on Postoperative Mortality and Morbidity: A Multicentre Cohort Study.** *BMJ Qual. Saf.* 2020. PMID: 33028658

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Shay D, Ng PY, Dudzinski DM, Grabitz SD, Mitchell JD, Xu X, Houle TT, Bhatt DL, Eikermann M. **Preoperative Heart Failure Treatment Prevents Postoperative Cardiac Complications in Patients with Lower Risk: A Retrospective Cohort Study.** *Ann. Surg.* 2021. PMID: 33534230

#### Grants and Funding

Title: The Implementation of Sugammadex in an Academic Teaching Hospital and Its Effects on Postoperative Adverse Outcomes and Hospital Costs

Funded by: Merck

Dr. Maximilian Schaefer (Co-PI, BIDMC),

Dr. Matthias Eikermann (Co-PI, Montefiore Medical Center)

Title: Effects of the Orexin Receptor Antagonist Suvorexant on Sleep Architecture and Delirium in the Intensive Care Unit: A Randomized Controlled Trial

Funded by: Merck

Dr. Matthias Eikermann (PI)

Title: Philanthropic Donation (not project-specific)

Funded by: Dr. Jeff and Judy Buzen

Dr. Matthias Eikermann (PI)

#### Conclusion

It is our goal and vision to drive the field of perioperative outcomes research forward and to improve patient outcomes after surgery and critical care. Interdisciplinary collaborations between clinicians, researchers, nurses, pharmacists and administrators are at the core of our research efforts. We hope to maintain and expand these interactions in the future to further promote the study of patient-centered outcomes in perioperative medicine and critical care.



#### Young Researcher

##### Peter Santer, MD, PhD



Peter joined the department in September 2018 as a post-doctoral

research fellow after completing his PhD in pulmonary physiology at the University of Oxford, where he studied the interactions of hypoxia and iron metabolism in patients with COPD. He obtained his MD from Innsbruck Medical University, Austria, where he trained as an anesthesia resident for two years before embarking on an extended research journey. His experience spans several fields of biomedical research and includes a wide range of applications, from bench research to clinical trials. Under the mentorship of Drs. Matthias Eikermann, Krish Ramachandran and Max Schaefer at BIDMC, Peter works on research studies focusing on respiratory outcomes after surgery, pharmacological interventions in the ICU and quality and safety aspects surrounding anesthetic practice. He has published over 25 peer-reviewed research articles in several high-impact journals. Peter served during the last 1.5 years as the team leader of the former Eikermann and now Perioperative Outcomes Lab.



# Critical Care Research



**Daniel S. Talmor, MD, MPH**  
Chair of Anesthesia, Critical Care and Pain Medicine  
Edward Lowenstein Professor of Anaesthesia

“Our BIDMC intensive care physicians are world leaders in critical care research.”

## Who We Are

The ICU Clinical Research Group is a team of dedicated intensivists and researchers focused on improving outcomes for patients with critical illness. Our investigations are wide-ranging, with mechanistic work at the bench extending into translational work, as well as interventional clinical trials supported and informed by epidemiologic surveys. We perform qualitative research on ICU survivorship, provider moral distress, and ethics and humanities in the critical care environment. We investigate new drugs, novel mechanical ventilation management techniques and more. The most common disease targets are acute respiratory distress syndrome, sepsis and other organ failures.

We leverage a strong network of collaborators in other departments as well as critical care researchers across the United States and Canada. This cross-pollination leads to exciting and innovative ideas, with expanded resources to test novel hypotheses in multi-center studies.

We are equally committed to the development and mentorship of trainees and early-stage investigators. We frequently pair younger investigators with more senior investigators to begin work on established, funded projects. This leads to a comprehensive understanding of clinical research and team leadership, creating a path toward successful independent work. A number of alumnae have gone on to secure independent funding and are advancing critical care for the sickest of our patients.

## Prevention and Early Treatment of Acute Lung Injury

Along with Dr. Nathan Shapiro in the Department of Emergency Medicine, our group leads the Boston Clinical Center within the National Heart, Lung, and Blood Institute’s (NHLBI) Prevention and Early Treatment of Acute Lung Injury (PETAL) Network at the National Institutes of Health (NIH). Beth Israel Deaconess stands apart as the only anesthesia-based center within the PETAL Network. Our group works with the PETAL Steering Committee at large to design and execute clinical trials to improve outcomes for very ill and at-risk patients across the United States. As a clinical center, we oversee seven enrolling sites, each with harmonized critical care and emergency medicine research teams. (Team: Talmor, Shapiro, Banner-Goodspeed, Bose, O’Gara)

- CLOVERS: For patients in septic shock, is it better to maximize fluids or to administer vasopressors in the first 24 hours? **The Crystalloid Liberal or Vasopressors Early Resuscitation in Sepsis**, or CLOVERS, study is ongoing and has generated considerable interest in the scientific community. An ancillary project, CLOVERS STEM, aims to understand the cardiovascular mechanisms in early sepsis resuscitation obtaining

## Lab Directors

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Chair of Anesthesia, Critical Care and Pain Medicine  
Edward Lowenstein Professor of Anaesthesia

**Todd W. Sarge, MD**  
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Assistant Professor of Anaesthesia

## Lab Members

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**Sidharth Shankar**  
Research Assistant



global longitudinal strain data, a measure of cardiac contractility, via non-invasive echocardiograms. A network-wide project, SHAMROC, follows patients in the post-discharge period to measure the effect of the resuscitation strategy used on cognitive impairment and disability.

- ORCHID: Does hydroxychloroquine improve clinical outcomes for patients hospitalized with symptomatic COVID-19? **The Outcomes Related to COVID-19 Treated with Hydroxychloroquine Among Inpatients with Symptomatic Disease**, or ORCHID, trial enrolled 479 patients over three months, then was stopped early for futility. This robust study rapidly answered a very important clinical question at a crucial time in the COVID-19 pandemic.
- TICO/ACTIV-3: Do monoclonal antibodies modify the immune response to COVID-19-induced ARDS, or enhance viral control to limit disease progression? Part of the **Accelerating COVID-19 Therapeutic Interventions and Vaccines (ACTIV) trial, ACTIV-3: Therapeutics for Inpatients with COVID-19, or TICO**, is a phase III, randomized, blinded, controlled platform trial that allows investigational agents to be added and dropped during the course of the study within the same trial infrastructure. This novel and efficient study design permits testing of new agents against a constant control group. TICO is an international effort, with 97 sites across the globe. The trial is currently active and is now testing the fifth and sixth new agents, with over 1,200 patients enrolled.
- **DAMP-Mediated Innate Immune Failure and Pneumonia After Trauma—the Harvard-Longwood (HALO) Campus Area Consortium:** The innate immune response plays a pivotal role in the development and progression of lung inflammation. A five-year grant from the Department of Defense supports this exciting translational project in collaboration with the Department of Surgery at BIDMC, the Department of Surgery at Brigham and Women’s Hospital and the



Departments of Biology and Biological Engineering at Massachusetts Institute of Technology. The consortium is conducting sequential and overlapping studies in vitro and in vivo to address the role that danger signaling from danger-associated molecular patterns (DAMPs) derived from somatic tissue injuries plays in altering innate immune signaling in the lung in ways that predispose patients to pneumonia. (Team: Talmor, Robson, Shaefi, Banner-Goodspeed)

- A small pilot study, **Use of Alteplase in Compassionate Use of Tissue Plasminogen Activator (tPA) for Treatment of COVID-19 Associated Respiratory Failure, followed by a larger, multicenter trial, STARS:** Fibrinolytic Therapy to Treat ARDS in the Setting of COVID-19 Infection: A Phase 2a Clinical Trial, tested the idea that thrombolytic therapy with tissue plasminogen activator could improve the respiratory function of patients critically ill with COVID-induced acute respiratory distress syndrome (ARDS). These studies completed in March 2021, and results are expected in the coming months. (Team: Talmor, Shaefi, Baedorf Kassis, Banner-Goodspeed, with surgery collaborators Drs. Yaffe and Barrett)
- A multicenter project investigated the role that inhaled nitric oxide plays in improving severe hypoxemia for patients with COVID-19. **The Inhaled Nitric Oxide Gas Therapy in Mechanically Ventilated Patients with Severe Acute Respiratory Syndrome in COVID-19** trial recently completed enrollment, with results expected later this year. (Team: Bose, Shaefi, Baedorf Kassis, Banner-Goodspeed)
- **Use of inhaled anesthetics to prevent lung injury:** Volatile anesthetics have been shown to both prevent and minimize the extent of inflammatory lung injury in multiple preclinical models of ARDS, ventilator-induced lung injury, endotoxin exposure and pulmonary ischemia-reperfusion injury. Our recently completed single-center study looked at postoperative pulmonary complications in a cohort of patients undergoing cardiopulmonary bypass during cardiac surgery assigned to receive either inhaled anesthetic or total intravenous anesthetic regimen for their surgery. We hope to further explore the lung-protective potential of volatile anesthetics in critically ill patients at increased risk for ventilator-induced lung injury. (Team: O’Gara, Talmor)

### Leveraging Respiratory Mechanics to Improve Outcomes

Our group looks closely at the respiratory physiology underlying lung injury and response to treatment. (Team: Talmor, Sarge, Banner-Goodspeed, Schaefer, with pulmonary critical care collaborator Dr. Baedorf Kassis)

- **EASiVENT: Prospective, multicenter, randomized, controlled study comparing efficacy and safety of INTELLiVENT-ASV versus Non-automated Ventilation in adult ICU subjects.** Ventilator management is resource-intensive, requiring specialized training and adequate staffing. Automated ventilator management that adapts to real-time changes in patient condition has the potential to decrease case workload and shorten time on the ventilator. This is particularly important during



times of intensive care unit stress (such as a pandemic), or in surge ICU spaces or under-resourced settings. INTELLiVENT-ASV is a software accessory that automatically adjusts ventilation and oxygenation variables to keep the patient within clinician-set target ranges, from intubation until extubation. This trial of INTELLiVENT-ASV versus non-automated ventilation in adult ICU subjects explores the safety and efficacy of automated ventilation management.

- **EPVent-2: Esophageal-Pressure-Guided PEEP Titration Compared to an Empiric High-PEEP Strategy for Management of ARDS** was published in the *Journal of the American Medical Association*. This multi-center, randomized clinical trial found that both approaches lead to equivalent mortality rates and time off the ventilator for patients with ARDS. This project yielded a rich dataset of respiratory physiology recordings during the first seven days of mechanical ventilation in ARDS patients. We are using the data for a variety of secondary investigations to better understand how ventilator management can exacerbate or attenuate ventilator-induced lung injury. The biological specimens collected from trial participants are undergoing single- and multi-plex analyses to generate mechanistic data related to ARDS patient response and variations in ventilator strategies.
- **Ventilator PEEP Settings Guided by P-V Curve Analysis and Esophageal Manometry.** We are comparing the use of pressure-volume curves using PEEP to optimize compliance to the use of esophageal manometry, which can be utilized by adjusting PEEP to maintain positive end-expiratory transpulmonary pressures, limiting derecruitment and atelectrauma. This comparison will allow a more nuanced understanding of PEEP and how setting this pressure changes pulmonary mechanics and provides insight into the basic physiology of sick lungs.



- **Incidence of dyssynchronous spontaneous breathing effort, breath-stacking and reverse triggering in patients with severe hypoxemic lung injury.** The goals of the project include describing the incidence of several kinds of ventilator dyssynchronies and analyzing corresponding changes in respiratory physiology parameters. Ultimately, we hope to associate the incidence of ventilator dyssynchrony during the early phase of ARDS and acute hypoxic respiratory failure with outcomes and understand the relationship between sedation levels and regimens and the different types of dyssynchronies.
- **Adaptive Support Ventilation in ARDS. This single-center study compares respiratory physiology parameters** (i.e., tidal volumes, driving pressure, respiratory rate, compliance, peak airway pressures, plateau pressures, PEEP) with each ventilator technique and measures esophageal pressures to compare transpulmonary and respiratory system mechanics.
- **Investigating the association of mechanical power concepts with in-hospital survival.** This project utilizes data from the EPVENT and EPVENT-2 randomized, controlled trials to investigate the clinical merit of different concepts of mechanical power. This integrative, novel concept unifies tidal volume, inspiratory pressures and the respiratory rate to assess the energy delivered to the respiratory system by the ventilator. In a second phase, advanced statistical methods are applied to the MIMIC IV database to mimic clinical decision-making and investigate a causal relationship.



### Prevention and Treatment of Organ Dysfunctions in the Critically Ill

- **Deferoxamine for the Prevention of Cardiac Surgery-Associated Acute Kidney Injury.** Multiple lines of evidence support a central role of iron in causing acute kidney injury (AKI), including the finding that prophylactic administration of iron chelators attenuates AKI in numerous animal models. This randomized, blinded, multi-center clinical trial investigates iron chelator deferoxamine to ameliorate cardiac surgery-associated acute kidney injury. (Team: Shaefi)
- **Prevention of Organ Dysfunction After Cardiac Surgery.** This study banks data and specimens collected from patients after cardiac surgery. These samples will be assessed at a future date for kidney and other organ function and injury biomarkers with the aim of uncovering presently unclear mechanisms of postoperative organ dysfunction specifically following cardiac surgery. (Team: Shaefi)
- **Midodrine for the Treatment of Refractory Hypotension.** ICU discharge is often delayed by a requirement for intravenous vasopressor medications. This multicenter randomized trial evaluated the efficacy of midodrine as an ancillary therapeutic to shorten the duration of vasopressor treatment. In results recently reported in Intensive Care Medicine, the MIDAS study group reported that midodrine did not accelerate liberation from vasopressor treatment, and was not effective as a treatment for hypotension in critically ill patients. (Team: Eikermann, Shaefi, Santer)

- **Suvorexant and Sleep / Delirium ICU Patients.** Delirium and poor sleep are commonly reported among patients treated in the ICU. This single-center study will be expanding to additional sites, evaluating the efficacy of postoperative oral suvorexant treatment on nighttime wakefulness after persistent sleep onset, as well as delirium and delirium-free days among adult patients following cardiac surgery and recovering in the cardiac ICU. (Team: Eikermann, Santer)

### Improving Long-Term Outcomes After Critical Illness

The field of critical illness research has been expanded in recent years to look beyond immediate in-hospital outcomes to longer-term recovery and patient-centered outcomes. **Addressing Post-Intensive Care Syndrome** is a multicenter, prospective, observational study of survivors of acute respiratory failure (ARF) who are expected to be discharged home alive. Funded by the Department of Defense, this project examines the relationship between unmet needs after hospital discharge and patient-centered clinical outcomes. In 2021, this project was expanded to include COVID patients, and double the enrollment goal. This study is augmented by two ancillary projects gathering data on patient experience and expectation: the **Observational Study of Expected ARF Recovery** looks at patients' expectations for recovery compared with their functional status and quality of life six months after discharge. In **Establishing a Hierarchy of Preferred Outcomes Following ARF Among Survivors and Caregivers**, we interview patients and caregivers to understand which domains of recovery are most important at set intervals after their critical illness. (Team: Bose, Banner-Goodspeed)

### Medical Ethics in the Intensive Care Unit

Critical care research has also expanded to include humanities-oriented investigations. These research endeavors explore the burden of moral distress among providers, the impact of dyssynchronous perceptions of futility of care between caregivers and providers, and what it means to deliver compassionate, humane care in the ICU. The emerging portfolio in this space includes **Studying Unconscious Bias in End-of-Life Care in the ICU; Compassionate Care in the ICU; The Effect of a Pandemic on Stress, Burnout and Workplace Diversity Among Anesthesia Critical Care Trained Physicians in the U.S.; and Anxiety, Depression, Ethical and Moral Distress Associated with COVID 19 Among Doctors, Respiratory Therapists and Nurses Working at the Frontlines in the ICU.** (Team: Siddiqui, Sarge, Lisbon)



## Epidemiologic Investigations

Our group contributes to multiple nationwide and international investigations of ICU care delivery. This work serves to better quantify existing processes, identify areas for improvement and provide benchmark settings against which to measure the impact of research interventions.

- **VIRUS:** Launched on March 31, 2020, this was the first global registry of COVID-19 patients. VIRUS is administered by the Society of Critical Care Medicine and funded by the Gordon and Betty Moore Foundation. **The COVID-19 Viral Infection and Respiratory illness Universal Study** currently has contributors from 28 countries and data on over 70,000 hospitalizations. A publicly available dashboard provides snapshots of key metrics: <https://sccmcovid19.org>. This massive undertaking has led to three early publications, with multiple additional works in progress. (Team: Banner-Goodspeed, Bose, Kassis)
- **BLUE CORAL:** Part of the NIH/NHLBI PETAL network, this multicenter prospective cohort of 1,500 patients hospitalized with severe COVID-19 gathers detailed clinical and biologic phenotyping with systematic assessment during and after hospitalization. The data will answer key questions about the clinical characteristics, treatments, biology and outcomes of patients hospitalized with COVID-19. The study is expected to complete enrollment in the summer of 2021. (Team: Talmor, Banner-Goodspeed, Bose, O’Gara, Baedorf Kassis)
- **RED CORAL:** This observational, multicenter retrospective cohort of patients hospitalized with COVID-19 at sites in the PETAL network between April and June 2020 provides data for investigation of demographics, clinical characteristics, risk factors, care practices, outcomes and resource utilization of patients with severe acute COVID-19. Findings from this project have been submitted to *JAMA*, with multiple additional manuscripts in progress. An ancillary study, SEA CORAL, examines variations in hospital system responses to the COVID-19 pandemic across the country and has been published in *Critical Care Medicine*. (Team: Banner-Goodspeed, Talmor)
- **STOP-COVID:** This registry of patients critically ill with COVID-19 is a collaborative effort with hospitals across the United States. Data have been widely published, including in *JAMA Internal Medicine*, *BMJ* and *Critical Care Medicine*. (Team: Shaefi)
- **COVID 19 national registry.** Data from critically ill patients with COVID-19 are contributed to the registry of the American Society of Anesthesiology. (Team: Siddiqui)
- A retrospective examination of data from BIDMC, Massachusetts General Hospital and Brigham and Women’s Hospital looks at whether pregnant patients with COVID-19 treated with nitric oxide have different clinical outcomes than those not treated with nitric oxide. (Team: Shaefi)



- **NOTICE:** This retrospective study examines the clinical effects of inhaled nitric oxide among COVID-19 patients. (Team: Banner-Goodspeed, Bose)
- **WEAN SAFE:** in a follow-up to the widely-cited LUNG SAFE study (to which BIDMC contributed in 2014), this international epidemiologic survey prospectively captures mechanically ventilated patients to gather information on the natural history and clinical decision making surrounding ventilator weaning. The COVID-19 pandemic delayed analysis; however, results are expected in the coming year. (Team: Banner-Goodspeed, Baedorf Kassis)

## COVID-19 Research

During the early days of the COVID-19 pandemic, the ICU research portfolio converted rapidly to focus on SARS-CoV-2. Supported by the Center for Anesthesia Research Excellence (CARE), we launched four observational studies, including registries linked to the Society of Critical Care Medicine, NIH-funded PETAL Network and institutional CORE Group (principal investigator, D. Ngo). Investigators in the division explored 10 treatment studies, ultimately launching eight trials, including ORCHID for hydroxychloroquine (NIH/PETAL network), inhaled nitric oxide, alteplase for severe COVID-induced ARDS, ‘intellivent’ automated ventilation mode for respiratory failure, and a qualitative investigation of functional recovery in COVID survivors.



This successful pivot from traditional ICU research to COVID research in the early days of the pandemic reflects tremendous leadership from the division investigators and tireless work from the research staff in the CARE and ICU divisions.

- NOSARS: Inhaled Nitric Oxide Gas Therapy in Mechanically Ventilated Patients with Severe Acute Respiratory Syndrome in COVID-19. (Team: Bose, Shaefi, Baedorf Kassis, Banner-Goodspeed)
- STARS: Fibrinolytic Therapy to Treat ARDS in the Setting of COVID-19 Infection: A Phase 2a Clinical Trial (Genentech) (Team: Talmor, Shaefi, Banner-Goodspeed with surgery collaborators Drs. Yaffe and Barrett and pulmonary collaborator Dr. Baedorf Kassis)
- Compassionate Use of Tissue Plasminogen Activator (tPA) for Treatment of COVID-19 Associated Respiratory Failure (Team: Talmor, Shaefi, Banner-Goodspeed, with surgery collaborators Drs. Yaffe and Barrett)
- ORCHID: Outcomes Related to COVID-19 Treated with Hydroxychloroquine Among Inpatients with Symptomatic Disease (NIH) (Team: Talmor, N. Shapiro, Banner-Goodspeed)
- BLUE CORAL: Biology and Longitudinal Epidemiology of PETAL COVID-19 Observational Study (NIH) (Team: Talmor, N. Shapiro, Banner-Goodspeed)
- RED CORAL: PETAL Repository of Electronic Data COVID-19 Observational Study (NIH) (Team: Banner-Goodspeed)

- TICO/ACTIV-3: A multicenter, adaptive, randomized, blinded controlled trial of the safety and efficacy of investigational therapeutics for hospitalized patients with COVID-19 (NIH) (Team: Talmor, N. Shapiro, Banner-Goodspeed)
- VIRUS: Viral Infection and Respiratory Illness Universal Study: COVID-19 Registry and Validation of C2D2 (Critical Care Data Dictionary) (Moore Foundation; Society for Critical Care Medicine) (Team: Banner-Goodspeed, Bose, Baedorf Kassis)
- Observational Cohort of Patients Receiving Volatile Anesthetic Sedation During the COVID-19 Pandemic (O'Gara)
- NOTICE: Retrospective Chart Review to Evaluate Outcomes Among COVID-19 Patients Receiving INOmax (Nitric Oxide) Gas for Inhalation (Mallinckrodt) (Team: Banner Goodspeed, Bose)

## Future Directions

Looking ahead, we will continue to use data from our hypothesis-generating work to inform interventional trials to improve outcomes for our critically ill patients. Our rapid small studies and large collaborative projects lead to innovative and impactful research of pressing clinical problems. Our group is a leader in establishing clinical research networks. We look forward to expanding across the Beth Israel Lahey Health network in the coming months.

## Grants and Funding

The division has been extremely successful at obtaining research funding. Currently, the division research efforts operate under the following grants:

Title: Clinical Centers (CC) for the NHLBI Prevention and Early Treatment of Acute Lung Injury [PETAL] Network (U01)  
Funded by: NIH/NHLBI  
Dr. Daniel Talmor (PI)

CLOVERS: Crystalloid Liberal or Vasopressors Early Resuscitation in Sepsis  
Funded by: NIH/NHLBI  
Drs. Nathan Shapiro and Daniel Talmor (PIs)

BLUE CORAL: Biology and Longitudinal Epidemiology of PETAL COVID-19 Observational Study  
Funded by: NIH/NHLBI  
Dr. Daniel Talmor (PI)

RED CORAL: PETAL COVID-19 Observational Study  
Funded by: NIH/NHLBI  
PI: Dr. Daniel Talmor

PETAL Network International Coordinating Center for ACTIV-3 Trial Initiative  
Funded by: NIH/NHLBI  
Dr. Daniel Talmor (PI)

Title: DAMP-Mediated Innate Immune Failure and Pneumonia After Trauma  
Funded by: DOD  
Dr. Daniel Talmor (PI)

Title: Fibrinolytic Therapy to Treat ARDS in the Setting of COVID-19 Infection: A Phase 2a Clinical Trial  
Funded by: Genentech  
Dr. Daniel Talmor (PI)

Title: Prospective, Multicenter, Randomized, Controlled Study Comparing Efficacy and Safety of INTELLiVENT-ASV Versus Non-Automated Ventilation in Adult ICU Subjects  
Funded by: Hamilton Medical  
Dr. Daniel Talmor (PI)

Title: Sepsis and the Benefits of Permissive Hypoxia  
Funded by: NIH  
Dr. Shahzad Shaefi (PI)

Title: Deferoxamine for the Prevention of Acute Kidney Injury  
Funded by: NIH/NIDDK  
Dr. Shahzad Shaefi (PI)

Title: Proteomic Analysis of Postoperative Delirium from a Randomized Trial in Older Patients Undergoing Cardiac Surgery Exposed to Intraoperative Normoxia versus Hyperoxia: A Nested Case-Control Study  
Funded by: NIH  
Dr. Shahzad Shaefi (PI)

Title: Study of Treatment's Echocardiographic Mechanisms (CLOVERS-STEM)  
Funded by: NIH  
Dr. Somnath Bose (PI)

Title: Addressing Post-Intensive Care Syndrome (APICS)-01  
Funded by: DOD  
Dr. Somnath Bose (PI)

Title: Addressing Post-Intensive Care Syndrome Among Survivors of COVID (APICS-COVID)  
Funded by: DOD  
Dr. Somnath Bose (PI)

Title: Forging Interprofessional Education in the Perioperative Setting in the Time of COVID-19  
Funded by: BIDMC Center for Healthcare Delivery Science Innovation Grant  
Dr. Shahla Siddiqui (PI)

Title: Effects of the Orexin Receptor Antagonist Suvorexant on Sleep Architecture and Delirium in the Intensive Care Unit: A Randomized Controlled Trial  
Funded by: Merck  
Dr. Matthias Eikermann (PI)

Title: Observational Study Protocol Nitric Oxide Treatment in COVID-19 Evaluation (NOTICE)  
Funded by: Mallinckrodt Pharmaceuticals  
Valerie Banner Goodspeed, MPH (PI)

## SELECTED PUBLICATIONS

Baedorf Kassis E, Su HK, Graham AR, Novack V, Loring SH, Talmor DS. **Reverse Trigger Phenotypes in Acute Respiratory Distress Syndrome.** *Am. J. Respir. Crit. Care Med.* 2021. PMID: 32809842

Beitler JR, Sarge T, Banner-Goodspeed V, Gong MN, Cook D, Novack V, Loring SH, Talmor D, On Behalf of the EPVent-2 Study Group. **Effect of Titrating Positive End-Expiratory Pressure (PEEP) With an Esophageal Pressure-Guided Strategy vs an Empirical High PEEP-FIO2 Strategy on Death and Days Free From Mechanical Ventilation Among Patients With Acute Respiratory Distress Syndrome: A Randomized Clinical Trial.** *JAMA* 2019. PMID: 30776290

Brown SM, Bose S, Banner-Goodspeed V, Beesley SJ, Dinglas VD, Hopkins RO, Jackson JC, Mir-Kasimov M, Needham DM, Sevin CM. **Approaches to Addressing Post-Intensive Care Syndrome Among Intensive Care Unit Survivors.** *A Narrative Review. Ann. Am. Thorac. Soc.* 2019. PMID: 31162935

Madahar P, Talmor D, Beitler JR. **Transpulmonary Pressure-Guided Ventilation to Attenuate Atelectrauma and Hyperinflation in Acute Lung Injury.** *Am. J. Respir. Crit. Care Med.* 2020. PMID: 33227213

PETAL Investigators. **Early High-Dose Vitamin D3 for Critically Ill, Vitamin D-Deficient Patients.** *N. Engl. J. Med.* 2019. PMID: 31826336

PETAL Investigators. **Effect of Hydroxychloroquine on Clinical Status at 14 Days in Hospitalized Patients with COVID-19: A Randomized Clinical Trial.** *JAMA.* 2020. PMID: 33165621

Shaefi S, Brenner SK, Gupta S, O'Gara BP, Krajewski ML, Charytan DM, Chaudhry S, Mirza SH, Peev V, Anderson M, Bansal A, Hayek SS, Srivastava A, Mathews KS, Johns TS, Leonberg-Yoo A, Green A, Arunthamkun J, Wille KM, Shaukat T, Singh H, Admon AJ, Semler MW, Hernán MA, Mueller AL, Wang W, Leaf DE. **Extracorporeal Membrane Oxygenation in Patients with Severe Respiratory Failure from COVID-19.** *Intensive Care Med.* 2021. PMID: 33528595





# Center for Anesthesia Research Excellence (CARE)



**Maximilian S. Schaefer, MD**  
 Director, Thoracic Anesthesia  
 Director of Center for Anesthesia Research Excellence (CARE)  
 Assistant Professor of Anaesthesia

The Center for Anesthesia Research Excellence (CARE) is a departmental resource established to facilitate all aspects of clinical research within the Department of Anesthesia, Critical Care and Pain Medicine. CARE has consolidated expertise in the full spectrum of clinical research activities, from study start-up to execution, close-out and publication. This “one-stop shop” is a key resource for faculty members and trainees.

The core function of CARE is to facilitate the smooth flow of proposals from beginning to end. The range of services include: idea development; Institutional Review Board (IRB) submission support; subject recruitment and data capture; statistical support; and funding application assistance targeting departmental, industry, foundations and/or federal funding sources. CARE assigns project managers and research staff to assist in the execution of research projects. A statistical and data analysis core and writing support for the final publication are also available. CARE works closely with the Committee on Clinical Investigations, the Office of Sponsored Programs, the Clinical Trials Office and Harvard Catalyst’s Clinical Research Center at BIDMC. Furthermore, CARE offers a robust clinical research training program for new staff and early investigators. By simplifying and streamlining the research process for investigators, CARE helps faculty members and trainees succeed in their research endeavors.

CARE provides additional support for foreign postdoctoral research fellows and students’ entry, credentialing and training. We work across all Anesthesia divisions to provide research and compliance education, manage internal grants, foster collaboration, provide mentorship and promote independence.

## Education

Education lectures presented by CARE staff are held during Faculty Hour and are open to faculty and trainees. The topics are determined through a periodic survey of faculty and trainees, archived and available for viewing on our intranet site. Prior topics include statistics, power calculations, sample-size estimates, grantsmanship, the IRB application process, research consenting, and source documentation. The clinical research support staff benefits from continuing education on topics that include clinical issues, research conduct, research consenting and compliance. Monthly department-wide research rounds provide an opportunity for researchers to share work in progress. This facilitates communication and collaboration for trainees, peers and young investigators across divisions and labs. Periodic grand rounds presentations are given to the department with updates on ongoing research.

“By simplifying and streamlining the research process for investigators, CARE helps faculty members and trainees succeed in their research endeavors.”

## Team

- Valerie M. Banner-Goodspeed, MPH**  
Program Manager, Anesthesia Research  
Research Associate in Anaesthesia, HMS
- Julia Dwyer**  
Project Manager  
Resident Program Coordinator, CARE
- Krystal Capers, MPH**  
Project Manager
- Lauren Kelly, MPH**  
Biostatistician
- Evyne Gartner, BA**  
Regulatory Specialist
- Najla Beydoun, MD**  
Research Fellow
- Trishna Sadhwani, BA**  
Clinical Trials Specialist
- Ammar (Joseph) Al-Shaamma, BSc, MSc**  
Clinical Trials Specialist
- André de Souza Licht, BS**  
Clinical Research Coordinator
- Thy Nguyen, BA**  
Clinical Research Coordinator
- Samantha Proeschel, MS**  
Clinical Research Coordinator
- Ariana Saroufim, BS**  
Clinical Research Coordinator
- Melisa Joseph, BS**  
Clinical Research Assistant II
- Benjamin Hoenig, BS**  
Clinical Research Assistant II
- Andrew Toksoz-Exley, BS**  
Clinical Research Assistant
- Lauryn Tsai**  
Research Aide

## Successes

CARE has supported over 130 researchers since its inception, including anesthesia faculty and trainees as well as faculty from other departments. In the past two years, CARE has supported 34 projects and responded to 23 requests. Many requests are for multiple services, such as study design and statistical consultation, or database design as well as assistance with data collection. Faculty come to CARE both for one-time requests and return for assistance with additional projects. In the past two years, 40% of applicants requested help with multiple projects. Investigator Development

## Investigator Development

CARE established the Loring Research Scholar program, an ACGME-approved, dedicated resident research track that provides an additional year of training dedicated to research and has incentives for successful applicants. This track tailors research training and enhances the clinician-investigator pool within Anesthesia.

Over the past several years, four faculty members completed the Harvard School of Public Health Program in Clinical Effectiveness, and all are in the process of receiving their master of public health degrees.

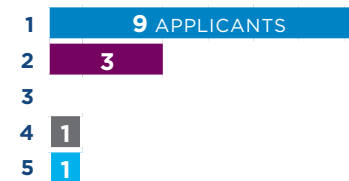
To develop a pipeline of “home-grown” independent clinician-scientists, the department has established a number of internal funding opportunities that are administered by CARE. These grants are intended for faculty members who are at the early stages of their scientific careers. Awards include the Seed and Career Development grants as well as the John Hedley-Whyte (JHW) Faculty Development Award within the HMS Eleanor and Miles Shore Fellowship Program. Currently, two JHW awardees are receiving mentorship and operational support from CARE to advance their selected research projects.

## Breakdown of CARE Services Requested (N=23)

CONCEPT	Design
	Mentorship
	Funding
STATISTICS	REDCap build
	Survey/CRF design
	Analysis
REGULATORY	IRB
	Site File
SUBJECTS	Data collection
	Screening
	Consenting
	OR/Bedside

## Repeat vs. One-time Applicants

HOW MANY REQUESTS Per Applicant





**HMS Eleanor and Miles Shore Fellowship John Hedley-Whyte Faculty Development Awardees**

- 2020: John Kowalczyk, MD, Section Head of Anesthesia for Gynecologic Surgery, for his proposal “Comparison of Non-Invasive Continuous Arterial Blood Pressure to Invasive Arterial Blood Pressure Measurement in Pregnant Women with Placenta Accreta.” Dr. Kowalczyk is mentored by Dr. Phil Hess and Dr. Yunping Li.
- 2021: Shahla Siddiqui, MD, for her proposal “Compassionate Care in the Intensive Care Unit.” Dr. Siddiqui is mentored by Dr. Bala Subramaniam and Dr. Danny Talmor.

**Career Development Awardees**

- 2020: Maximilian Schaefer, MD, for his proposal “Development of Strategies to Prevent Postoperative Respiratory Complications in Patients Undergoing One-Lung Ventilation for Thoracic Surgery.” Dr. Schaefer is mentored by Dr. Daniel Talmor and Dr. Matthias Eikermann.
- 2021: Augustin Melo Carillo, PhD, for his project “Narrow Band Green Light Effects on Cortical Processing in Naïve and Disease States.” Dr. Melo Carillo is mentored by Dr. Rami Burstein.

**Seed Grant Awardees**

- 2019: Maria Serena Longhi, MD, PhD, for her project “Antisense to CD39 Promotes Inflammation in Inflammatory Bowel Disease.”
- 2020: Valluvan Rangasamy, MD, for his project “Customized Health Technology Based Application for Integrating Multidimensional Frailty Assessment (FRAIL-MD) in Routine Perioperative Care.” Dr. Rangasamy is mentored by Drs. Subramaniam, Kim and Marcantonio.

ACTIVE CRITICAL CARE PROJECTS SUPPORTED BY CARE IN 2019-2021		
TITLE	PI	CARE STAFF
Prospective, Multicenter, Randomized, Controlled Study Comparing Efficacy and Safety of INTELLiVENT-ASV Versus Non-automated Ventilation in Adult ICU Patients	Daniel Talmor, MD MPH	Current: Valerie, Andre, Krystal, Andrew
Addressing Post-Intensive Care Syndrome (APICS)-01 (APICS-COVID extension)	Somnath Bose, MD	Current: Valerie, Andre, Krystal, Andrew, Julia Past: Ben, Maria
Inhaled Nitric Oxide Gas Therapy in Mechanically Ventilated Patients with Severe Acute Respiratory Syndrome in COVID-19	Somnath Bose, MD	Current: Valerie, Andre, Krystal, Andrew, Julia
Observational Study of Expected ARF Recovery (OSEAR)	Somnath Bose, MD	Current: Valerie, Andre, Krystal, Andrew Past: Ben, Maria
Establishing a Hierarchy of Preferred Outcomes Following Acute Respiratory Failure Among Survivors and Caregivers	Somnath Bose, MD	Current: Valerie, Andre, Krystal, Andrew, Lauren Past: Ben, Maria, Clair
BLUE CORAL: Biology and Longitudinal Epidemiology of PETAL COVID-19 Observational Study	Daniel Talmor, MD MPH	Current: Valerie, Andre, Krystal, Andrew
RED CORAL: PETAL Repository of Electronic Data COVID-19 Observational Study	Daniel Talmor, MD MPH	Current: Valerie, Andre, Krystal, Andrew, Mel
Compassionate Use of Tissue Plasminogen Activator (tPA) for Treatment of COVID-19 Associated Respiratory Failure	Daniel Talmor, MD MPH	Current: Valerie, Andre, Krystal, Andrew Past: Joseph
STARS (“Study of Alteplase for Respiratory Failure in SARS-Cov2 [COVID-19]”), a Phase IIa Clinical Trial	Daniel Talmor, MD MPH	Current: Valerie, Andre, Krystal, Andrew Past: Joseph

CARE, Critical Care Research Team

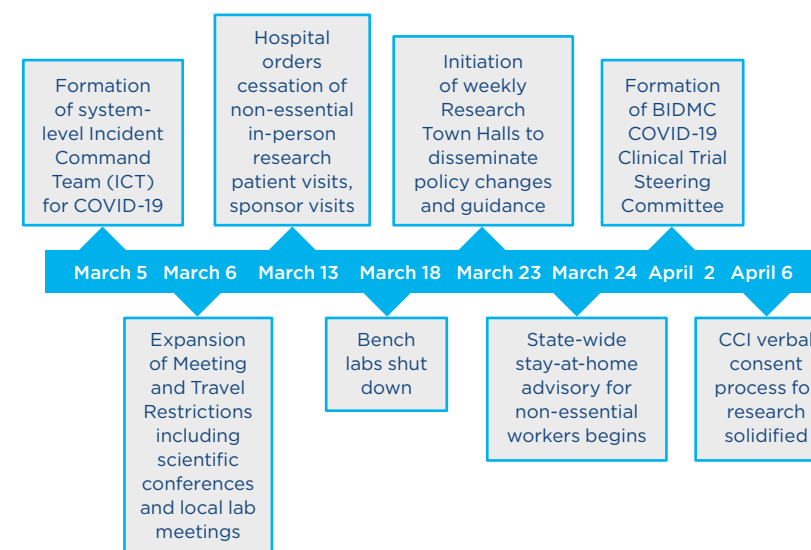


ACTIVE CRITICAL CARE PROJECTS SUPPORTED BY CARE IN 2019-2021, continued		
TITLE	PI	CARE STAFF
DAMP-Mediated Innate Immune Failure and Pneumonia After Trauma—The Harvard-Longwood (HALO) Campus Area Consortium	Daniel Talmor, MD MPH	Current: Valerie, Andre, Krystal, Andrew, Lauren Past: Ben, Maria
Adaptive Support Ventilation in ARDS	Daniel Talmor, MD, MPH	Current: Valerie, Andre, Krystal, Andrew, Lauren Past: Ben, Maria
Observational Cohort of Patients Receiving Volatile Anesthetic Sedation During the COVID-19 Pandemic	Brian O’Gara, MD, MPH	Current: Valerie, Mel Past: Thy, Marie
Nitric Oxide Treatment In COVID-19 Evaluation (NOTICE)	Valerie Banner-Goodspeed, MPH	Current: Andre, Krystal, Lauren
Viral Infection and Respiratory Illness Universal Study (VIRUS): COVID-19 Registry	Valerie Banner-Goodspeed, MPH	Current: Lauren, Krystal, Andre, Andrew, Mel, Trishna, Najla Past: Ben, Maria, Maria, Thy
PETAL (Intermountain) CLOVERS-STEM: CLOVERS-Study of Treatment’s Echocardiographic Mechanisms	Somnath Bose, MD	Current: Valerie, Andre, Krystal, Andrew, Past: Ben, Maria
The Frequency of Screening and SBT Technique Trial: The FAST Trial	Elias Baedorf Kassis, MD	Current: Valerie, Julia, Andre, Krystal, Andrew
Incidence of Dyssynchronous Spontaneous Breathing Effort, Breath-Stacking and Reverse Triggering in Patients with Severe Hypoxic Lung Injury	Elias Baedorf Kassis, MD	Current: Valerie, Andre, Krystal, Andrew Past: Ben, Maria
Characterization and Risk Factors of De Novo Prescriptions of Medications Post-Discharge in COVID-19 Patients	Somnath Bose, MD	Current: Valerie, Lauren, Andre, Krystal, Andrew

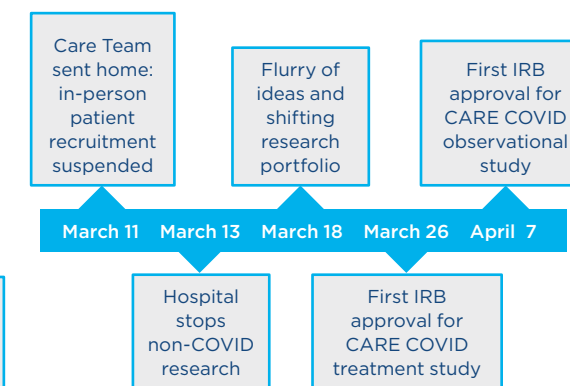
**Investigators Supported by CARE**

- Musa Aner, MD
- Ruma Bose, MD, MBBS
- Elias Baedorf Kassis, MD
- Valerie Banner-Goodspeed, MPH
- Somnath Bose, MD, MBBS
- Matthias Eikermann, MD, PhD
- Massimo Ferrigno, MD
- Jatinder S. Gill, MBBS, MD
- Philip E. Hess, MD
- Samir M. Kendale, MD
- John J. Kowalczyk, MD
- Akiva Leibowitz, MD
- Maria Serena Longhi, MD, PhD
- Robina Matyal, MBBS
- John D. Mitchell, MD
- Brian P. O’Gara, MD, MPH
- Qi Ott, MD
- Achi Oren-Grinberg, MD, MS
- Julie Petro, MD
- Richard J. Pollard, MD
- Simon C. Robson, MD, PhD
- Maximilian S. Schaefer, MD
- Shahla Siddiqui, MD, MSc,
- Thomas T. Simopoulos, MD, MA
- BalaSubramaniam, MD, MPH
- Daniel Talmor, MD, MPH
- Andrea Tsai, AM, MD

**Navigating Research in a Pandemic**



**CARE COVID Response: Portfolio Shift**





### Resident Research Program

The department is committed to supporting and facilitating research opportunities for clinical trainees. In residency training, participation in research takes multiple forms. Residents commonly work on research projects outside of their clinical responsibilities without dedicated research time, but for those looking for a more in-depth experience, there is an option to utilize all or a portion of their elective time for research.

The goal of the BIDMC Anesthesia Resident Research Program is to facilitate educational, rewarding and productive research experiences for residents in the department. Residents are given protected time and resources through the program and CARE to learn the basics of clinical or bench research. During their research month, residents participate in or lead a research project related to their career goals and interests and ultimately begin their journey toward meaningful research that advances the knowledge of their specialty.

Each year, residents who participate in the research program are encouraged to select a research mentor who can aid in developing or enhancing their investigative skills. The program assists as needed with finding a suitable mentor, and residents can also benefit from the informal guidance of Anesthesia Department research leadership. In addition, CARE helps facilitate all aspects of the residents' research projects.

Over the past two years, the Resident Research Program has supported the following

RESIDENT RESEARCH PROJECTS SUPPORTED BY CARE IN 2019-2021		
RESIDENT	RESEARCH PROJECT	MENTOR
Omar Elmadhoun	Oxygen Titration in the ICU – Everything in Moderation <i>Publication: Invited Submission to JICM</i>	Dr. Shaefi
Justin De Biasio	Proteomic Changes Associated with Cardiopulmonary Bypass for Coronary Artery Bypass Surgery <i>Publication: Abstract presentation</i>	Dr. Shaefi
Ronny Munoz-Acuna	The effects of subanesthetic ketamine on respiratory stimulation and transpulmonary pressures in mechanically ventilated critically ill patients <i>Publication: Abstract presentation</i>	Dr. Eikermann
Stephan Hain	Intraoperative Hypotension and Postoperative AKI	Dr. Eikermann
Priya Ramaswamy	Machine Learning Derived ASA Scores Outperform Anesthesiologists in Predicting Mortality and Post-Operative Outcomes <i>Publication: Society for Technology in Anesthesia Annual Meeting</i>	Dr. Eikermann
John Bellamente	Incorporating Video-Based Feedback and Deliberate Practice in Teaching Asleep Fiberoptic Intubation	Dr. Ma
Justin Mark Lunderberg	Ecto-Enzyme Modulation of Murine Inflammation	Dr. Robson
Rabia Amir	Detection of Biomarkers for Perioperative Right Ventricular Dysfunction	Dr. Shaefi
Puja Shankar	The Variable Antimicrobial Effect of Carbon Monoxide on In Vitro Neutrophil Killing and Phagocytosis	Dr. Shaefi
Raghav Seth	Establishing a Multidimensional Frailty Assessment (MUFA) in Routine Perioperative Care for the Elderly	Dr. Subramaniam
Warren Southerland	Association Between Reported Pain Reduction and Pain Scores in Spinal Cord Stimulation Patients: Cross-Sectional Study	Dr. Gill
Sumanth Kuppalli	Survey of Practice Parameters of Physicians Implanting Spinal Cord Stimulators	Dr. Gill
Amnon Berger	The Association Between Different Concepts of Mechanical Power with Mortality in Critically Ill Patients	Dr. Schaefer

13 participants in a wide variety of clinical and bench research projects.

### Research Student Program

A key component of the department's overall strategic plan is the development of young clinician scientists interested in furthering the knowledge of the specialty. In support of this goal, we host medical students for research internships. CARE

has hosted multiple summer fellowship students over the past few years through the Foundation for Anesthesia Education and Research or through requests from interested students. Students are matched with a research mentor with established projects and are expected to meaningfully contribute as part of the research team. In addition, students participate in targeted educational opportunities.

ACTIVE PERIOP AND PAIN PROJECTS SUPPORTED BY CARE IN 2019-2021, <i>continued on p. 172</i>		
TITLE	PI	CARE STAFF
Prospective Randomized Clinical Evaluation of the Neuroanatomical Lead Position Using the Senza™ Spinal Cord Stimulation (SCS) System in the Treatment of Chronic Intractable Back and Leg Pain	Jatinder Gill, MD	Current: Trishna
A Prospective, Multicenter, Randomized, Double-Blinded, Sham-Controlled Study to Evaluate the Efficacy and Safety of Clonidine Micropellets for the Treatment of Pain Associated with Lumbosacral Radiculopathy in Adults: RePRIEVE-CM (Radicular Pain Relief via Epidural Injection of Clonidine Micropellets)	Jatinder Gill, MD	Current: Valerie, Trishna Past: Joseph, Marie
A Multicenter, Randomized, Follow-Up Study to Evaluate the Long-Term Safety of Clonidine Micropellets for the Treatment of Pain Associated with Lumbosacral Radiculopathy in Adults: RePRIEVE-CM-LT (Radicular Pain Relief via Epidural Injection of Clonidine Micropellets Long-Term)	Jatinder Gill, MD	Current: Valerie, Trishna Past: Joseph, Marie
Complications of Spinal Cord Stimulators	Thomas Simopoulos, MD	Current: Valerie, Trishna Past: Joseph, Marie
RELIEF—A Global Registry to Evaluate Long-Term Effectiveness of Neurostimulation Therapy for Pain	Thomas Simopoulos, MD	Current: Valerie, Trishna
Alterations of Purinergic Signaling in Inflammatory Bowel Disease	Simon C. Robson, MD, PhD	Current: Valerie, Trishna, Najla, Mel

CARE, Perioperative Research Team



### Spotlight on the Medical Director

The inaugural medical director of CARE, Bala Subramaniam, MD, MPH, led the center for seven productive and exciting years. In 2021, Dr. Subramaniam launched his newly established Sadhguru Center for a Conscious Planet, and Maximilian Schaefer, MD, assumed the role of medical director of CARE.



**Dr. Schaefer** trained in Germany and joined the department in 2019 as an attending anesthesiologist and assistant professor in anesthesia. His research interests include the

application of innovative concepts such as mechanical power and electrical impedance tomography or xenon-based anesthesia to prevent complications and improve patient recovery after surgery, with a focus on postoperative pulmonary complications. His habilitation (PhD equivalent) and *venia legendi* (teaching credentials) were awarded in 2019 from Heinrich-Heine University, Dusseldorf, Germany, and addressed the “Influence of the Inhalational Anesthetic Xenon on Anesthesia-Associated Risks and Postoperative Recovery.”

With the addition of Dr. Schaefer as medical director, the center has now integrated the Perioperative Outcomes Research Group alongside the existing Critical Care, Perioperative and Pain Management groups. This group leverages large data sets and applies a broad variety of advanced statistical methods to answer timely and relevant questions related to patient outcomes following anesthesia and surgery through both retrospective and prospective observational studies. The Perioperative Outcomes Lab has a long tradition of supporting questions raised by clinician principal investigators in the department and perfectly supplements the mission of CARE.



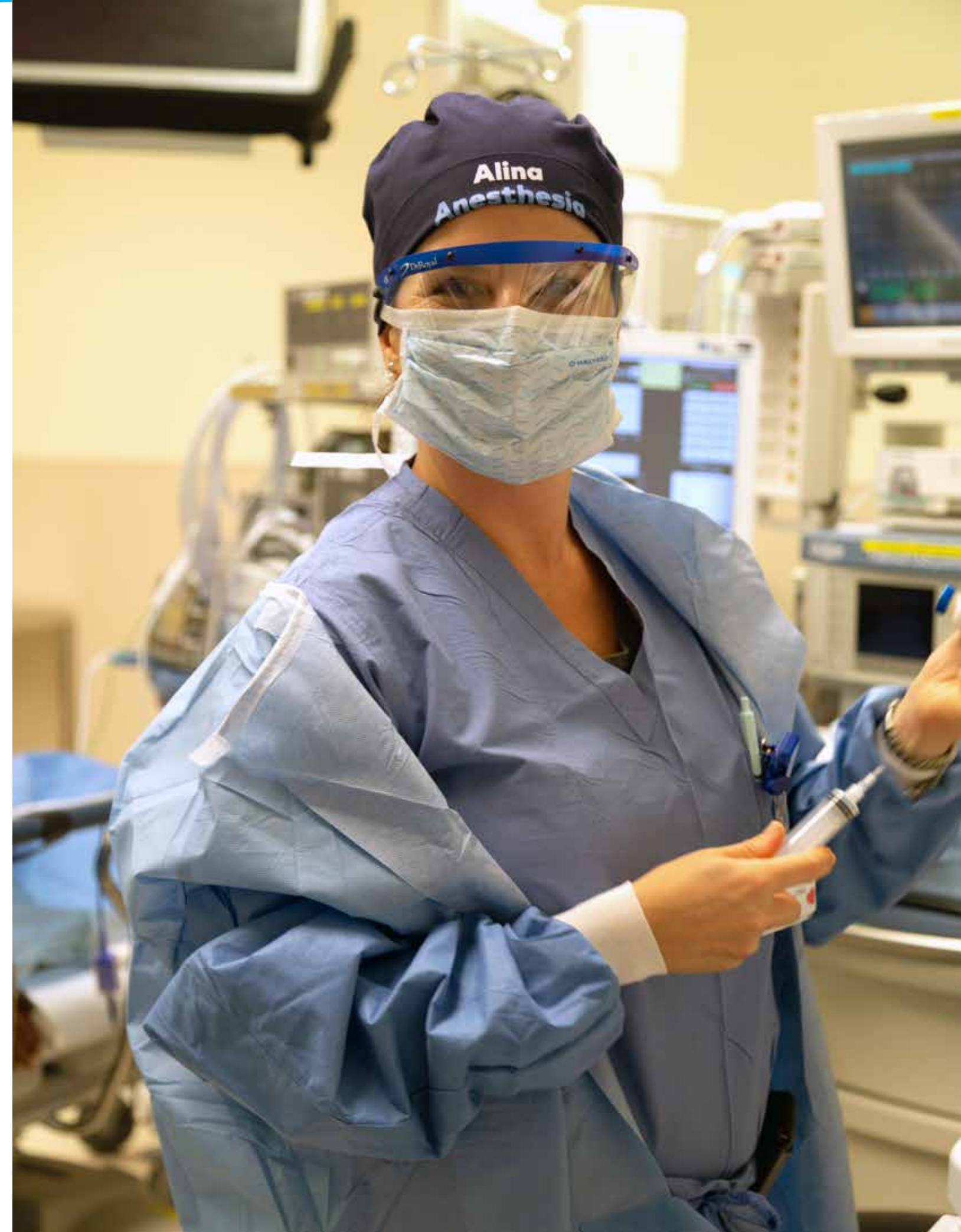
**ACTIVE PERIOP AND PAIN PROJECTS**

**SUPPORTED BY CARE IN 2019-2021**, *continued from p. 171*

TITLE	PI	CARE STAFF
Prevention of Early Postoperative Decline	Brian O’Gara, MD, MPH	Current: Valerie, Mel Past: Thy, Marie
The Use of Dantrolene to Improve Analgesia in Posterior Lumbar Surgery	Richard J. Pollard, MD	Current: Valerie, Julia, Mel, Najla, Trishna, Lauren Past: Sam, Thy, Marie
Virtual Reality in the Operating Room: Using Immersive Relaxation as an Adjunct to Anesthesia	Brian O’Gara, MD, MPH	Current: Valerie, Julia, Mel, Najla, Trishna Past: Sam, Thy, Marie
Identification of Genetic Causes of Calcific Aortic Valve Disease	Simon C. Robson, MD, PhD	Current: Valerie, Julia, Mel, Najla, Trishna Past: Sam, Thy, Marie
Gender Bias in the Perioperative Setting	Qi Ott, MD; John Mitchell, MD	Current: Valerie, Julia, Lauren Past: Sam, Thy, Marie
Virtual Reality as an Adjunct to Anesthesia for Patients Undergoing Knee Replacement Surgery	Brian O’Gara, MD, MPH	Current: Julia, Mel, Najla, Trishna, Lauren
Postoperative Virtual Reality for Recovery after Bariatric Surgery	Brian O’Gara, MD, MPH	Current: Julia, Mel, Najla, Trishna, Lauren
Comparison of Continuous Non-Invasive Arterial Blood Pressure to Invasive Arterial Blood Pressure Measurement in Pregnant Women with Placenta Accreta	John Kowalczyk, MD	Current: Julia
Opioid Weaning Protocol to Improve Clinical Outcomes in Patients on Chronic Opioids Undergoing Spine Fusion Surgery	Musa Aner, MD	Past: Valerie, Julia, Joseph, Marie, Lauren



CARE, Clinical Trials staff





# Center for Education Research, Technology and Innovation (CERTAIN)



**John D. Mitchell, MD**  
 Vice Chair, Education  
 Director, Center for Education Research, Technology and Innovation  
 Associate Professor of Anaesthesia

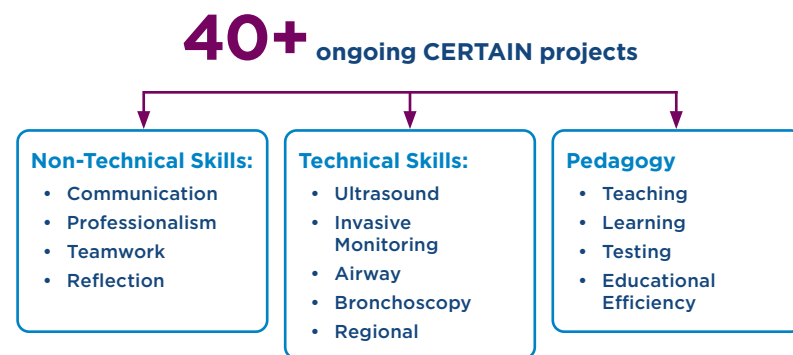
“Science is the search for truth—it is not a game in which one tries to beat his opponent, to do harm to others.”  
 —Linus Pauling

Over the last year, CERTAIN has embarked on a wide range of exciting and fruitful research projects spanning the full breadth of educational endeavors, including technical skills, non-technical skills and novel approaches to teaching and learning. We have supported dozens of projects involving many researchers across our department, aiding them with every aspect of their research endeavors. We are grateful for the opportunity to serve our department and look forward to shaping the way teaching and learning are accomplished in our field.

## General Overview

The Center for Education Research, Technology and Innovation (CERTAIN) develops, tests, and deploys a dynamic learning environment that optimizes learning for all participants and enhances patient outcomes. We focus on addressing issues in three core areas: technical skills, non-technical skills and pedagogy. Each of these areas requires different research techniques to approach and investigate correctly, and team members are encouraged to focus in one core area to develop their expertise and portfolio. We have developed a team that has strengths across key investigative techniques required for successful research across the full range of educational topics. We presently manage over 40 projects that engage more than 30 faculty from our department.

Some noteworthy projects are discussed in more detail below. They include successful application of machine-learning technology to evaluate the quality and utility of written feedback, exploration of interprofessional education as a means of enhancing emotional intelligence and integrating hand-motion feedback into comprehensive training courses for procedural skills.



## Members

- Cullen D. Jackson, PhD**  
 Instructor in Anaesthesia  
 Associate Director, CERTAIN
- Vanessa T. Wong, BS**  
 Project Coordinator
- Michael Chen, BS**  
 Education Lab Manager
- Vincent Baribeau, BS**  
 Clinical Research Assistant
- Dustin Lin, MS**  
 Clinical Research Assistant
- Lauren K. Buhl, MD, PhD**  
 Associate Program Director,  
 Anesthesia Residency  
 Instructor in Anaesthesia
- Lior A. Levy, MD**  
 Director, Resident Simulation  
 Instructor in Anaesthesia
- Haobo Ma, MD, MS**  
 Instructor in Anaesthesia
- Kadhiresan R. Murugappan, MD**  
 Instructor in Anaesthesia
- Sara E. Neves, MD**  
 Program Director, Anesthesia Residency  
 Instructor in Anaesthesia
- Ameeka Pannu, MD**  
 Program Director, Anesthesia Critical  
 Care Fellowship  
 Instructor in Anaesthesia
- Lindsay A. Rubenstein, MD**  
 Associate Program Director, Anesthesia  
 Residency  
 Instructor in Anaesthesia
- Aidan M. Sharkey, MD**  
 Instructor in Anaesthesia
- Shahla Siddiqui, MD, MSc**  
 Assistant Professor of Anaesthesia
- Daniel P. Walsh, MD**  
 Site Director for Critical Care,  
 BID-Plymouth  
 Associate Program Director, Anesthesia  
 Residency  
 Instructor in Anaesthesia

## Residents Supported

- Aamir Abbas, DO
- Sumanth Kuppalli, MD
- Miheer Sane, MD, MPH
- R. Trevor Sherburne, MD,
- Andres de Lima Arboleda, MD

We have hosted multiple courses, including a recent course for Navy Special Operations combat medics to learn point-of-care ultrasound in an accelerated fashion by applying enhanced hand-motion feedback.

Challenges include identifying funding sources and venues for publication. We have already had early success on both fronts but aim to expand our reach in both areas in the years to come by submitting our work more broadly for both funding and publications.

CERTAIN is directed by Dr. John D. Mitchell, who has extensive experience in medical education research and teaching. Dr. Mitchell is vice chair of education for the department and was the long-term program director of our anesthesia residency program before stepping down to devote his time to CERTAIN and departmental leadership. Dr. Mitchell is president-elect of the Society for Education in Anesthesia.

## Mentorship

We train future educational leaders and provide them with support to conduct meaningful educational research projects while avoiding common pitfalls. Mentorship is integral to this process. We actively mentor faculty and residents in both project and career development. Drs. Mitchell and Jackson are presently the primary mentors, but we are training other team members to fill these roles over time. A team approach to research is strongly endorsed, and our projects involve over 30 department members to date. Ms. Wong, Mr. Chen, Mr. Baribeau and Mr. Grondin provide essential advice and support to investigators based on their wealth of experience in education research as well, aiding in the development process of new investigators.





## Research

### Grants and Funding

Title: Physically Realistic Virtual Surgery—Virtual Operating Room Team Experience (VORTeX)

Funded by: NIH

Principal Investigator (PI): Dr. Cullen Jackson (PI); Dr. John Mitchell (Co-Investigator)

This multi-institution project will develop and test a virtual reality operative simulation experience that engages team members across disciplines without co-locating them physically. We are presently developing the scenarios and virtual reality environment.

Title: Forging Interprofessional Education in the Perioperative Setting in the Time of COVID 19

Funded by: Center for Healthcare Delivery Science Innovation

Dr. Shahla Siddiqui (PI), Dr. John Mitchell (Mentor)

Emotional intelligence is an aspect of leadership and coping in life that is beneficial in molding health care workers and developing interprofessional communication and relationships. Our goal is to improve emotional intelligence among anesthesia and surgery trainees and nurses to enhance interprofessional communication and teamwork in the post-anesthesia care unit.

Title: Hand-Motion Assessment for Objective Evaluation of Central Line Placement: From Simulation to Real-World Application

Funded by: CRICO

Dr. John Mitchell (Co-PI) and Dr. Jeffrey Weinstein (Co-PI); Drs. Muneeb Ahmed and Aidan Sharkey (Co-Investigators)

### Awards and Honors

Dr. John Mitchell

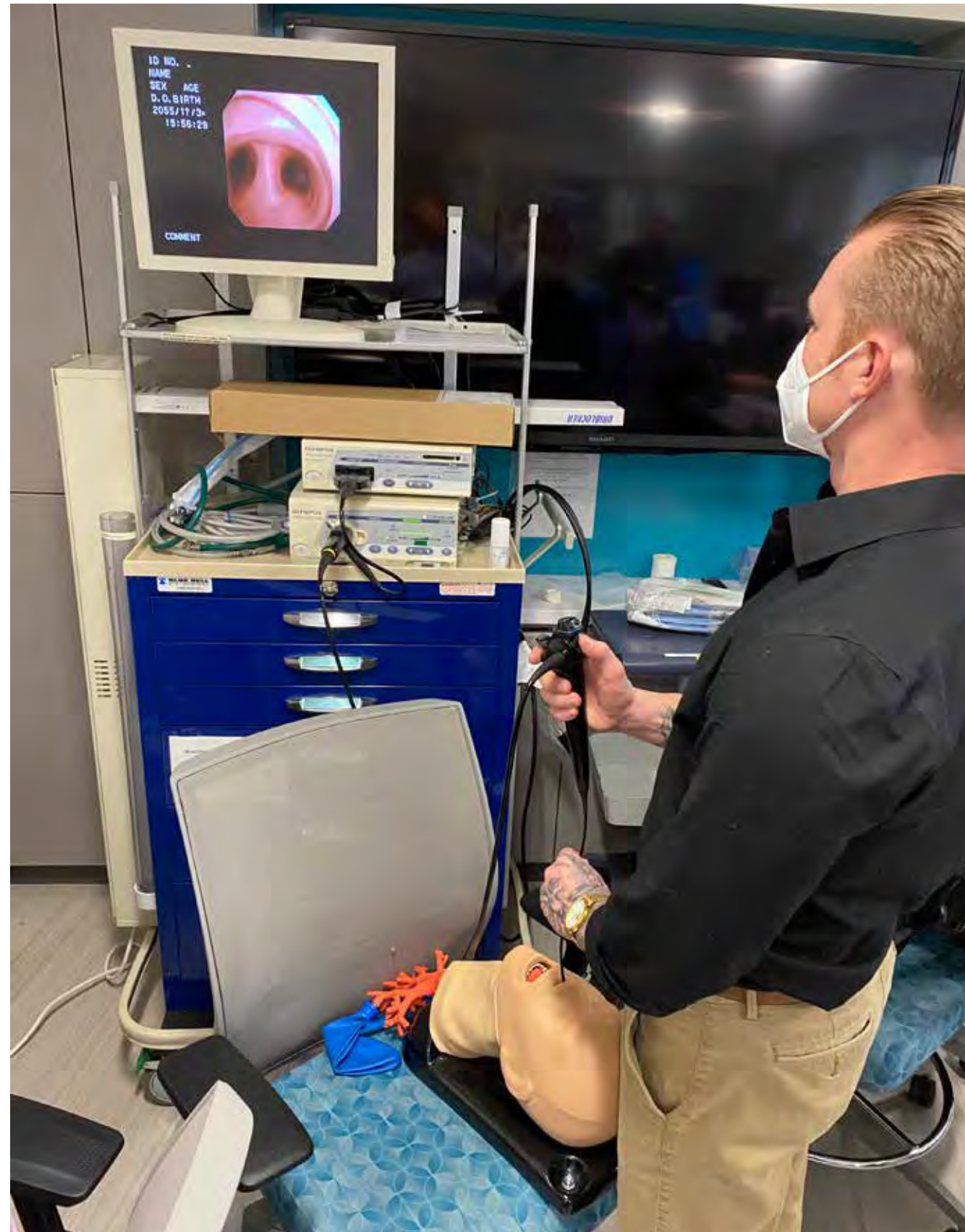
Distinguished Educator in Anesthesiology, American Society of Anesthesiology and Society for Education in Anesthesia (2019)

President-Elect, Society for Education in Anesthesia (2020)

Vice Chair of Education (2021)

Dr. Sara Neves

Chair Designee, Resident Education Committee, Society for Education in Anesthesia (2020)



### Significant Publications

- Mitchell JD, Ku CM, Lutz B, Shahul S, Wong V, Jones SB. **Customizable Curriculum to Enhance Resident Communication Skills.** *Anesth. Analg.* 2019. PMID: 30829671

Accompanied by an editorial: **The Time to Address Curriculum and Evaluation for Nontechnical Skills Is Now.** Abatzis VT, Littlewood KE. *Anesth. Analg.* 2019. PMID: 31613807

Dr. Mitchell led a group that developed and implemented an iPad-based rating scale to assess resident communication skills by surveying almost 1,200 patients. Following data collection, the results were shared with each resident and an improvement plan involving simulation and reflective work formulated for each individual based on their areas most in need of improvement. Follow-up patient surveys demonstrated significant improvement for residents who were not already scored as perfect.

- Neves SE, Chen MJ, Ku CM, Karan S, Dilorenzo AN, Schell RM, Lee DE, Diachun CAB, Jones SB, Mitchell JD. **Using Machine Learning to Evaluate Attending Feedback on Resident Performance.** *Anesth. Analg.* 2021. PMID: 33323789

Under the guidance of Dr. Mitchell, Dr. Neves and Mr. Chen lead a national group of educators in developing a machine-learning model to identify low-quality and utility written feedback for trainees. The model was able to provide successful triage of these types of comments. Next the team plans to improve the model to help identify high performers as well. We believe these efforts will help train faculty to provide improved feedback and real-time support for educators as they provide feedback.

- Buhl LK, Nozari A. **More Even Distribution of ACGME-mandated Cases Improves Residents' Perceptions of Fairness and Balance.** *J Educ. Perioper. Med.* 2020. PMID: 33447648

Dr. Buhl applied her skills in scheduling in this innovative publication showing the importance of managing subspecialty case assignments in a way that engenders a sense of fairness and balance of education and service among residents.

- Martinelli SM, Chen F, Isaak RS, Huffmyer JL, Neves SE, Mitchell JD. **Educating Anesthesiologists During the COVID-19 Pandemic and Beyond.** *Anesth. Analg.* 2021. PMID: 33201006

- Selected as article of the month for the March 2021 edition of *Anesthesia and Analgesia*
- Accompanied by an online interview/podcast

Drs. Neves and Mitchell collaborated with a national group of educational experts to provide guidance in optimal educational approaches to apply during pandemic restrictions and into the future. This work was selected as an article of the month for March 2021 and was accompanied by an online interview/podcast. Dr. Mitchell was the senior mentor on this project.



- Ma H, Ruan X, Wong VT, Guo W, Huang Y, Mitchell JD. **Identifying the Gap Between Novices and Experts in Fiberoptic Scope Control.** *J. Educ. Perioper. Med.* 2021. PMID: 33778100

Dr. Ma used a combination of deliberate practice and video-based feedback in the teaching of fiberoptic intubation, a critical airway management skill. By using the picture-in-picture approach to allow simultaneous evaluation of the view from the fiberoptic scope and the view of the participant, he assessed the hand motions with the scope motions. He validated a checklist for assessing fiberoptic scope controlling during fiberoptic intubation as part of this project.

- Buhl LK, Wong V, Jones SB. **Teaching Medical Students to Create Anesthetic Plans Using a Branched-Chain Learning Module.** *A. A. Pract.* 2021. PMID: 33793431

Dr. Buhl developed and implemented an innovative branched-chain learning module approach to teach medical students. This “choose-your-own-adventure” style approach proved both popular and practical and has many exciting implications for future use in education.

- Ambardekar AP, Walker KK, Mackenzie-Brown AM, Jackson C, Edgar L, Ellinas H, Long TR, Trombetta CE, Laskey M, Wargo B, Dainer R, Draconi C, Mitchell JD. **The Anesthesiology Milestones 2.0: An Improved Competency-Based Assessment for Residency Training.** *Anesth. Analg.* 2021. PMID: 33764340

Dr. Mitchell is the senior author on this paper describing the process and rationale behind creation of the second iteration of the ACGME Milestones for Anesthesiology. He worked with the ACGME Milestones 2.0 taskforce for over a year to develop the new milestones and a companion guide to facilitate their use.

## Conclusion

CERTAIN has been extremely active and productive since it was founded in late 2019 and now has a robust portfolio of research. Despite the challenges of COVID, its first two years saw 17 accepted manuscripts, over 30 abstracts and multiple grants and presentations for members. Over 30 different faculty members have worked with CERTAIN on research, and our program is growing as we draw even more investigators into our thriving group. Our team members are nationally recognized as experts in education and education research and serve in many key national roles in education research and leadership in multiple organizations, including (but not limited to) the Society for Education in Anesthesia, Association of Anesthesia Core Program Directors, American Board of Anesthesiology, Inter Hospital Study Group, Anesthesia Toolbox Project and the Society for Neuroscience in Anesthesia and Critical Care. Heading into our second full year, we anticipate increased collaboration both within and outside of the department, further enhanced academic output and more national exposure for members.



## Young Investigators

### Lauren K. Buhl, MD, PhD



When she was starting her research career as a drosophila neurobiologist, Dr. Buhl never imagined she would end up doing medical education research, but now she is clearly a rising star in that area. When she realized during residency that

she would not be able to commit as much time to research as required in basic science, she explored other outlets and found fulfillment in teaching and education research. Following a fellowship in medical education research at the Academy at Harvard Medical School, she initially focused on curriculum development. Starting with work revamping the neuroanesthesiology rotation at Beth Israel Deaconess Medical Center (BIDMC), she branched out into national organizations and now works on neuroanesthesiology curricula for the Society for Neuroscience in Anesthesia and Critical Care and is the section editor for neuroanesthesiology at Anesthesia Toolbox. She recently turned her childhood love of Choose Your Own Adventure books into a publication on using branched-choice frameworks to illustrate the complexities of anesthetic decision making to medical students.

Dr. Buhl also has an inexplicable love for scheduling that she applied in a recent publication showing the importance of managing subspecialty case assignments in a way that engenders a sense of fairness and balance of education and service among residents. Her current focus is determining how the power narratives of struggle and failure can be harnessed for effective teaching, encouraging a growth mindset, promoting provider resilience, enabling professional identity formation and improving patient safety. While her own teaching style relies heavily on stories of her own mistakes, there is actually very little research into whether and how these stories work, making it an ideal area for investigation.

### Haobo Ma, MD, MS



Dr. Ma is an anesthesiologist and intensivist with a background in clinical outcomes research who has recently discovered a passion for medical education research. This enthusiasm is grounded in his commitment to helping residents transition from textbook

knowledge to clinical skills. Dr. Ma contributes to the Critical Thinking Working Group through the BIDMC Shapiro Center for Education and serves as a mentor in the BIDMC global health training program. In addition, he led the development of an international anesthesia rotation at Peking Union Medical College Hospital in Beijing. His primary educational focus is identifying the most effective teaching methods for advanced airway skills.

Dr. Ma recently finished a two-year fellowship program in medical education research through the Academy at Harvard Medical School. During the program, he piloted using a combination of deliberate practice and video-based feedback in the teaching of fiberoptic intubation. By using the picture-in-picture approach to allow simultaneous evaluation of the view from the fiberoptic scope and the view of the participant, he can assess the hand motions with the scope motions. He has validated a checklist for assessing fiberoptic scope controlling during fiberoptic intubation (FOI) and published it in the *Journal of Education in Perioperative Medicine*. To further explore innovative ways to teach FOI, he recently developed a prototype 3D-printed modular airway model. He plans to conduct a task analysis of FOI so that he can create a new FOI teaching method using the 3D-printed modular airway model and applying cognitive load theory and deliberate practice theory.





# Obstetric Anesthesia Research Lab



**Philip E. Hess, MD**

Executive Vice Chair  
Program Director, Obstetrical Anesthesia Fellowship  
Associate Professor of Anaesthesia

“We aim to conduct high-impact research to enhance women’s health during labor and delivery and beyond.”

The mission of the Division of Obstetric Anesthesiology is to create an environment that fosters excellence in clinical care, research and education. Our goal is to help labor and delivery be as pain- and complication-free as possible for our mothers and infants. As physician-researchers, we bring our clinical insights to basic and translational research and conduct studies that will enhance the evidence base in obstetric anesthesia to improve the care we provide to our pregnant patients.

We engage in clinical and bench research focused on topics relevant to obstetric anesthesia. The following are descriptions of some of our ongoing projects.

- **Do parturients have normal gastric emptying during labor?** Our current nil per os (NPO) policy to minimize the aspiration risk in pregnant women is based on the Curtis Lester Mendelson observation in the 1940s that there is a higher incidence of pulmonary aspiration among obstetric patients who underwent vaginal or cesarean delivery under general anesthesia. Obstetric anesthesia has evolved tremendously since that time. The widespread use of neuraxial analgesia/anesthesia has driven the U.S. rate of general anesthesia at <5%. Evidence is increasing that the NPO policy may have minimal effect on the rate of aspiration. However, the rate of gastric emptying in pregnant women during labor is partially studied using indirect measurement of paracetamol absorption. In a randomized controlled trial, Dr. Phil Hess is examining the rate of gastric emptying with an ultrasound technique that allows oral intake evaluation in laboring women who ingest either carbohydrate-based or a protein-based sports drink.
- **Is quadratus lumborum block superior to transversus abdominus plane block for analgesia post Cesarean delivery?** Ultrasound-guided quadratus lumborum block (QL) is a relatively new fascial plane block that can provide effective post-cesarean analgesia when intrathecal morphine is not used. It remains unclear whether QL block produces more prolonged analgesia than transversus abdominus plane (TAP) block, so a direct comparison of these two methods is needed. Dr. Yunping Li led a study with Nanjing Maternal and Child Health Care Hospital in China that divided participants into three groups: QL, TAP or sham control. The patient-controlled analgesia (PCA) dose of butorphanol was compared between the groups. Findings showed that QL block had fewer PCA requests and lower visual pain scores but was not statistically different than TAP block.

## Members

Erin J. Ciampa, MD, PhD  
Instructor in Anaesthesia

Meredith I. Colella, MD  
Instructor in Anaesthesia

John J. Kowalczyk, MD  
Section Head of Anesthesia for Gynecologic Surgery  
Instructor in Anaesthesia

Lior A. Levy, MD  
Director, Resident Simulation  
Instructor in Anaesthesia

Yunping Li, MD  
Division Director, Obstetric Anesthesia  
Associate Professor of Anaesthesia

Maria Borrelli, MD  
Fellow

JoAnn Jordan, MS  
Data Manager

Padraich Flahardy  
Research Assistant



- **Is non-invasive blood pressure monitoring inferior to invasive arterial line in the management of placental accreta spectrum?** Four of the five leading causes of maternal death require close blood pressure monitoring, including preeclampsia with severe features, maternal hemorrhage and cardiac comorbidities in high-risk pregnant women. Beth Israel Deaconess Medical Center (BIDMC) has established the New England Center for Placental Disorders to focus on improving the treatment of women with placenta accreta. Obstetric hemorrhage occurs frequently in mothers with placenta accreta. We typically monitor these patients with an invasive intra-arterial catheter for continuous blood pressure readings. In a study led by Dr. John Kowalczyk and funded by the John Hedley-Whyte Fellowship, we will measure effectiveness of non-invasive arterial pressure monitoring compared to invasive arterial pressure monitoring in awake women undergoing cesareans. A key secondary goal of the study is to assess potential markers of volume depletion to see if there is a target to improve fluid repletion in these pregnant patients.
- **Prospective evaluation of the effects of IV ketorolac on platelet function post-Cesarean delivery.** Cesarean delivery is the most common surgical procedure in the United States. Use of non-steroidal anti-inflammatory drugs (NSAIDs) has been shown to improve the quality of post-cesarean analgesia and reduce opioid consumption. The effect of NSAIDs on healthy volunteers is relatively well studied. However, there is limited data examining the potential platelet inhibitory effect of NSAIDs in the setting of physiologic changes of pregnancy combined with surgical tissue trauma at cesarean delivery. In a prospective, randomized, double-blinded, placebo-controlled trial, Dr. John Kowalczyk and his colleagues are performing platelet aggregometry and thromboelastography before and after a dose of intravenous ketorolac at cesarean delivery to quantify the potential inhibitory effect of ketorolac on platelet function.
- **The molecular mechanisms responsible for the onset of parturition and mouse model of mitochondrial dysfunction and preterm labor.** The United States has one of the lowest mortality rates in the world for premature infants, but we have not had a significant breakthrough in preventing preterm labor in over 30 years. During this time, the preterm labor rate has almost doubled, and neonatal intensive care is estimated to cost the health care system \$26.2 billion a year in the United States. It is vital that we work to better understand molecular mechanisms responsible for preterm labor in order to improve outcomes for these infants. Dr. Erin Ciampa is particularly passionate about this research topic. She is currently studying the molecular mechanisms of aging and mitochondrial dysfunction in the placenta with the aim to determine the molecular mechanisms of preterm labor. She has also created a novel cell-based model of cellular senescence that will provide a valuable tool to study mechanisms that initiate labor.



## SELECTED PUBLICATIONS

Ciampa EJ, Hess PE. **Hypertension, Preeclampsia, and Eclampsia.** In: **Principles and Practice of Maternal Critical Care.** Editors: Einav S, Weiniger CF, Landau R. Cham, Switzerland: Springer International Publishing AG. 2020. ISBN 978-3-030-43476-2

Ciampa EJ, Liu N, Stiles J, Carani JL, Li Y, Hess PE. **Heterozygote Carriers of Mutations in the F11 Gene, Encoding Factor XI, Have Normal Coagulation by Thromboelastography During Pregnancy.** *Int. J. Obstet. Anesth.* 2020. PMID: 31791878

Hess PE, Wylie BJ, Golen T, Shinker SA, Zera C, Li Y. **Keeping Pregnant Patients Safe During COVID-19 Pandemic.** *Matern.-Fetal Med.* 2020. (Editorial)

Kimaresan A, Shapeton AD, Yuan H, Hess PE. **Transthoracic Echocardiographic Assessment of the Right Ventricle Before and After Cesarean Delivery: A Preliminary Investigation.** *Anaesth. Intensive Care.* 2020. PMID: 32106692

Kowalczyk JJ, Carvalho B, Collins J. **Transnasal Humidified Rapid-Insufflation Ventilatory Exchange for Elective Laryngeal Surgery During Pregnancy: A Case Report.** *A. A. Pract.* 2019. PMID: 31592829

Kowalczyk JJ, Evers A. **Pregnancy and Hypertension.** In: Chu L, Traynor A, eds. *Manual of Clinical Anesthesiology.* 2nd ed. Philadelphia, PA: Lippincott Williams & Wilkins; 2020.

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Sween LK, Xu S, Li C, O'Donoghue MA, Ciampa EJ, Kowalczyk JJ, Li Y, Hess PE. **Low Dose Intravenous Dexmedetomidine Reduces Shivering Following Cesarean Delivery.** *Int. J. Obstet. Anesth.* 2020. PMID: 33293185

## Grants and Funding

Title: Mouse Model of Mitochondrial Dysfunction and Preterm Labor  
Funded by: Harvard Anesthesia NIH Institutional T32 training grant  
Erin Ciampa, MD, PhD (PI)

Title: Comparison of Continuous Non-Invasive Arterial Blood Pressure to Invasive Arterial Blood Pressure Measurement in Pregnant Women with Placenta Accreta  
Funded by: John Hedley-Whyte Faculty Development Program, Harvard Medical School, and BIDMC Department of Anesthesia, Critical Care and Pain Medicine  
John Kowalczyk, MD (PI)

Title: Molecular Mechanisms Responsible for the Onset of Parturition  
Funded by: Society for Obstetric Anesthesia and Perinatology Young Investigator Award Grant  
Erin Ciampa, MD, PhD (PI)

Evaluation of the Effects of IV Ketorolac on Platelet Function Post-Cesarean Delivery  
Funded by: Society for Obstetric Anesthesia and Perinatology Young Investigator Award Grant  
John Kowalczyk, MD (PI)

## Awards

Gertie Marx Research Competition: Low-Dose Intravenous Dexmedetomidine Reduces Shivering Following Cesarean Delivery,  
Lindsay Sween, MD, MPH



## Young Investigators

### Erin Ciampa, MD, PhD



Dr. Erin Ciampa is a passionate and skilled physician-investigator committed to improving outcomes for pregnant women and their infants. She studies molecular mechanisms of aging and metabolic disease in the placenta. She is currently supported by the Harvard Anesthesia

National Institutes of Health Institutional T32 training grant and is also the 2020-2021 awardee of a Society for Obstetric Anesthesia and Perinatology Young Investigator Grant. She is mentored by Samir Parikh, MD, a BIDMC nephrologist and world-renowned scientist with expertise in the cellular response to stress and mitochondrial dysfunction. Her work in the Parikh lab applies recent breakthroughs describing metabolic mechanisms of aging to placental physiology to better understand how this organ may contribute to pathological pregnancy outcomes.

Dr. Ciampa's work has already had significant impact. She demonstrated that pathways well defined in other cell types linking mitochondrial dysfunction to aging are intact in trophoblast cells. Upon exposure to an agent that mimics hypoxia, trophoblast cells in culture accrue mitochondrial dysfunction, become senescent, and adopt transcriptional signatures shared with placental cells analyzed at the end of gestation. This *in vitro* model represents a powerful tool for further genetic and pharmacological manipulations to identify factors that will increase the cells' resilience to stress and aging. Dr. Ciampa has also created a mouse-based model of preterm labor that she will describe in an upcoming publication. This model creates opportunities for future studies to characterize the molecular changes accompanying preterm labor and to test potential therapeutic interventions. Finally, the *in vitro* and mouse-model arms of her project are complemented by a study of human tissues, which harnesses the power of modern single-cell whole transcriptomics to relate findings from her experimental models to human physiology.

After transitioning from doctoral work in cardiac electrophysiology to her current focus on placental physiology and metabolism, Dr. Ciampa-authored a publication in *Hypertension* describing protein changes in cerebrospinal fluid in preeclampsia. She has also published in the *International Journal of Obstetric Anesthesia*, the *American Journal of Obstetrics and Gynecology* and *Anesthesia and Analgesia*.



### John Kowalczyk, MD



Despite a very busy clinical and teaching schedule, Dr. Kowalczyk has already had a fast-tracked start to his career as a physician-investigator. Most of his research focuses on obstetric hemorrhage and

coagulopathies, and he has published papers in major journals in the field. In addition, he is the director of anesthesia for gynecologic surgery at BIDMC and has presented at national meetings of the Society for Obstetric Anesthesia and Society of Maternal Fetal Medicine.

After completing medical school at the University of Rochester School of Medicine and Dentistry in Rochester, NY, Dr. Kowalczyk became a resident at University Hospitals Case Western Medical Center in Cleveland, OH. During his second year of residency, he had an experience as a patient that led him to a passion for improving patient care and clinical research. He served as the PI for retrospective and prospective randomized controlled trials on the effect of ketorolac and postpartum hemorrhage. During a fellowship at Stanford Medical Center and Lucile Packard Children's Hospital, his research led to a total of six publications, including an expert consensus statement in *Anesthesia and Analgesia* with the Society for Obstetric Anesthesiology's Taskforce Recommendation on monitoring after intrathecal opioids. He was awarded the Society for Obstetric Anesthesia and Perinatology Young Investigator Research Grant for a quantitative study evaluating ketorolac effects on platelet inhibition following cesarean section as measured by platelet aggregometry and thromboelastography.

He joined BIDMC in the fall of 2017 as an attending and started conducting research and mentoring residents and obstetric anesthesiology fellows. In 2020, Harvard Medical School and BIDMC awarded him the John Hedley-Whyte Research Grant through the Eleanor and Miles Shore Faculty Development Award Program to investigate continuous non-invasive arterial blood pressure monitoring in pregnant women with placenta accreta.



# Arnold - Warfield Pain Center Research Lab



**Thomas T. Simopoulos, MD, MA**

Director, Pain Medicine  
Co-Director, Spine Clinic  
Associate Professor of Anaesthesia

Our research program within the Arnold - Warfield Pain Center at BIDMC investigates a variety of questions related to pain management. Our recent work has focused on outcomes for epidural blood patch; patient populations receiving vertebral augmentation; and patient characteristics and outcomes in those with spinal cord stimulation therapies. Our group also publishes on current key topics, such as COVID-19 impact on pain practice, cannabinoids in pain medicine and opioid therapy. Despite the unique challenge brought on by the pandemic to both pain practice and research, our group has continued to remain active in our research activities. We completed two industry-funded projects, one of which was an investigational device exemption for a new injectable therapeutic for lumbar radiculopathy. In addition, Dr. Jatinder Gill initiated a study funded by Boston Scientific that establishes the Arnold - Warfield Pain Center as a site for evaluating the effectiveness of their commercially approved neurostimulation systems to relieve pain.

## Active Protocols and Funding

Title: Complications of Spinal Cord Stimulators  
Dr. Thomas Simopoulos (PI)

Title: RELIEF: A Global Registry to Evaluate Long-Term Effectiveness of Neurostimulation Therapy for Pain  
Funded by: Boston Scientific  
Dr. Jatinder Gill (PI)

Title: Survey of Practice Parameters of Physicians Implanting Spinal Cord Stimulators  
Dr. Jatinder Gill (PI)

Title: A Multicenter, Randomized Follow-Up Study to Evaluate the Long-Term Safety of Clonidine Micropellets for the Treatment of Pain Associated with Lumbosacral Radiculopathy in Adults: RePRIEVE-CM-LT (Achieving Radicular Pain Relief via Epidural Injection of Clonidine Micro Pellets)  
Dr. Jatinder Gill (PI)

Title: A Discarded Tissue Study to Characterize the Effects of Laser on Spine Tissue  
Dr. Jatinder Gill (PI)

“Our ongoing aim in the field of neurostimulation is to expand knowledge that will improve patient care.”

## Team Members

Jatinder S. Gill, MBBS, MD  
Associate Professor of Anaesthesia

Jyotsna V. Nagda, MD  
Director of QA/QI, Pain Medicine  
Assistant Professor of Anaesthesia

Viet L. Cai, MD  
Instructor in Anaesthesia

Cyrus A. Yazdi, MD  
Instructor in Anaesthesia

Title: The Utility of Thoracolumbar Injury Classification and Severity (TLICS) Score in the Management of Vertebral Compression Fractures; Prognostication of Outcomes  
PI: Dr. Jatinder Gill

Title: A Pilot Study to Develop a Radio-Anatomic Landmark for the Posterior Lumbar Epidural Space  
PI: Dr. Jatinder Gill

## Conclusion

A primary focus of our pain research over the past several years has been identifying optimal techniques for interventions and exploring clinical aspects of spinal cord stimulation. Our ongoing aim in the field of neurostimulation is to expand knowledge that will improve patient care. We continue to gain national recognition in these areas and look forward to future partnerships with industry for ongoing support of our research goals.

## SELECTED PUBLICATIONS

Gill JS, Breeze JL, Simopoulos TT. **Pain Management Best Practices from Multispecialty Organizations During the COVID-19 Pandemic and Public Health Crises-Evaluating the Risk of Infection Associated with Corticosteroid Injections.** *Pain Med.* 2020. PMID: 32500153

Orhurhu V, Agudile E, Chu R, Urits I, Orhurhu MS, Viswanath O, Oluabunwa E, Simopoulos T, Hirsch J, Gill J. **Socioeconomic Disparities in the Utilization of Spine Augmentation for Patients with Osteoporotic Fractures: An Analysis of National Inpatient Sample from 2011 to 2015.** *Spine J.* 2020. PMID: 31740396

Simopoulos T, Sharma S, Wootton RJ, Orhurhu V, Aner M, Gill JS. **Discontinuation of Chronic Opiate Therapy After Successful Spinal Cord Stimulation Is Highly Dependent Upon the Daily Opioid Dose.** *Pain Pract.* 2019. PMID: 31199551





# Quality, Safety, Informatics and Innovation Lab



**Satya Krishna Ramachandran, MD, MBBS**

Vice Chair, Quality, Safety, Innovation and Informatics  
 Program Director, Perioperative Quality and Safety Fellowship  
 Associate Professor of Anaesthesia

“We create virtuous cycles through visionary academic, operational and research programs to maximize our individual and organizational value.”

Our lab researches issues that impact health care quality and safety and promotes knowledge transfer using state-of-the-art methods. We study epidemiology, root causes, human factors, resilience, interventions, implementation and outcomes as they relate to the quality, safety and innovation of health care. Using team-science approaches, we engage our diverse clinical and technical stakeholders in our investigations and provide them key resources such as reliable data, visualizations, logistical and analytic support and guidance through our content experts and collaborators.

Dr. Ramachandran is a leader in research in perioperative quality and safety at BIDMC, the Beth Israel Lahey network and CRICO. He has mentored students, nurses, residents, doctoral and post-doctoral researchers, fellows and faculty over the past 15 years. Through our innovative two-year Perioperative Quality and Safety Fellowship and the Health Care Delivery Innovation Fellowship, we have a dedicated team of scholars who are committed to expanding their research and operational expertise. Together with Dr. Ramachandran, the fellows provide a rich resource of peer and senior mentorship that has resulted in significant quality and safety innovations in the clinical setting and numerous peer-reviewed publications. In addition, successful collaborations with Harvard Medical School and the Royal College of Anaesthetists ensure a continual wider set of co-mentors who are well placed to guide and promote successful academic careers among junior investigators.

## Grants and Funding

Title: Concise Out-of-Operating Room Interprofessional In-Situ Exercises (CONcISE): CRICO Grant  
 Funded by: CRICO  
 Dr. Krish Ramachandran (PI)

## Awards

Best research team project: Safe Anaesthesia Liaison Group Annual Conference, UK

## Team Members

- Sarah Nabel, MS**  
 Director, Quality, Safety, Innovation and Informatics  
 Associate in Anaesthesia, HMS
- Peter Santer, MD, DPhil**  
 Richard J. Pollard, MD  
 Director Pre-Admission Testing  
 Director, Quality Improvement  
 Director, Neuroanaesthesia  
 Fellowship  
 Assistant Professor of Anaesthesia
- Samir M. Kendale, MD**  
 Division Director, Neuroanaesthesia  
 Member of the Faculty
- Liana Zucco, MBBS, MSc**  
 QSI Fellow - Graduated 2021
- Nadav Levy, MD**  
 QSI Fellow - Graduated 2021
- Matthew Needham, MBBS**  
 QSI Fellow
- Salameh Obeidat, MD**  
 QSI Fellow
- Jeff Keane, RN**
- Reshma Abraham, MPH**  
 Safety Project Management
- Andrea Azocar**  
 Research Assistant

## SELECTED PUBLICATIONS

Bradley SM, Zhou Y, Ramachandran SK, Engoren M, Donnino M, Girotra S. **Retrospective Cohort Study of Hospital Variation in Airway Management During In-Hospital Cardiac Arrest and the Association with Patient Survival: Insights from Get with The Guidelines-Resuscitation.** *Crit. Care.* 2019. PMID: 31060580

ElMoaqet H, Kim J, Tilbury D, Ramachandran SK, Ryalat M, Chu CH. **Gaussian Mixture Models for Detecting Sleep Apnea Events Using Single Oronasal Airflow Record.** *Applied Sciences.* 2020. doi: 10.3390/app10217889

Feuerstein JD, Levy N, Zucco L, Levy LA, Sawhney M, Ramachandran SK. **Management of a COVID-19 Patient in the Endoscopy Suite.** *VideoGIE.* 2020. PMID: 32391445

Kim J, ElMoaqet H, Tilbury DM, Ramachandran SK, Penzel T. **Time Domain Characterization for Sleep Apnea in Oronasal Airflow Signal: A Dynamic Threshold Classification Approach.** *Physiol. Meas.* 2019. PMID 30524019

Levy N, Zucco L, Ehrlichman RJ, Hirschberg RE, Hutton Johnson S, Yaffe MB, Ramachandran SK, Bose S, Leibowitz A. **Development of Rapid-Response Capabilities in a Large COVID-19 Alternate Care Site Using Failure Modes and Effect Analysis with In-Situ Simulation.** *Anesthesiology.* 2020. PMID: 32773686

Li Y, Ciampa EJ, Zucco L, Levy N, Colella M, Golen T, Shainker SA, Lunderberg JM, Ramachandran SK, Hess PE. **Adaptation of an Obstetric Anesthesia Service for the SARS-CoV-2 Pandemic: Description of Checklists, Workflows, and Development Tools.** *Anesth Analg.* 2021. PMID: 33315601

Zucco L, Santer P, Levy N, Hammer M, Grabitz SD, Nabel S, Ramachandran SK. **A Comparison of Postoperative Respiratory Complications Associated with the Use of Desflurane and Sevoflurane: A Single-Centre Cohort Study.** *Anaesthesia.* 2021. PMID: 32743803

## Young Investigator

**Nadav Levy, MD**



Dr. Levy is a brilliant safety scientist and one of our inaugural Perioperative Quality and Safety Fellows. Focusing on translational and in-situ simulation training, he created a program of brief in-situ team training drill capsules. In our lab, he has developed these pilot concepts to a full-fledged, funded program to study the influence of frequency of in-situ drills on

critical measures of patient safety and culture. The CONcISE project is currently running in procedural units across the Beth Israel Lahey system, allowing inter-disciplinary teams to practice in their own environments.

Brief In-Situ Simulation Drills

Interventional Procedural Units

Focus on Hazard Recognition



**Concise Out of operating room Interprofessional In-Situ Exercises**

[Train with your team](#) | [Train in your workplace](#) | [Within working hours](#)

CONcISE is a research project studying the efficacy of simulation-based team training, to promote teamwork & detect latent hazards within your workplace



Procedural areas (out of the operating room) are considered high risk from patient safety and medicolegal perspectives, particularly if anesthesia support is required.

**Serious adverse events are associated with failures in technical skill, clinical judgment, communication, documentation and insufficient team training.**

### What can you expect?

- Opportunity to participate in short 30min drills
- Debriefing focused on latent hazard detection
- Surveys assessing safety culture & risk mitigation
- We come to you! No need to travel!

CONcISE@bidmc.harvard.edu IRB 2020P000820



# Sadhguru Center for a Conscious Planet

## Enhancing Consciousness, Cognition, and Compassion



**Balachundhar Subramaniam, MD, MPH**

Professor of Anaesthesia  
 Director, Sadhguru Center for a Consciousness Planet  
 Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC

“Consciousness being the fundamental intelligence that crafts both body and brain, Conscious Planet is the way forward for all issues within and without.”  
 —Sadhguru, Yogi, Mystic, and Visionary

The Sadhguru Center for a Conscious Planet, founded in 2020, is a multidisciplinary research center that combines science and yoga and meditation practices to create interventions that promote overall well being and health. The Center conducts research, facilitates thoughtful conversations and exploration, and builds awareness through education and community outreach. We use our unique approach to expand our experience and understanding of human consciousness, cognition and compassion. Our mission is to enhance the holistic health of the community and to advance scientific frontiers through rigorous research in contemplative sciences, build collaborative partnerships, and offer tools for well being and transformation. We conduct rigorous, cross-disciplinary research for mental and physical health outcomes. Significant collaboration with prominent neuroscientists, physicians and biomedical researchers is involved to more deeply investigate, through physiological and psychological correlates, how consciousness, cognition and compassion are aided by meditative practices.

The Sadhguru Center faculty work closely with colleagues across BIDMC, Harvard Medical School as well as national and international experts in various fields. Our research employs both clinical and mindfulness-based interventions, such as multimodal intraoperative general anesthesia and opioid-sparing effective pain control in the postoperative period to improve post-operative outcomes, particularly related to cognitive decline and delirium that often occur in aged patients. We design and facilitate yoga and meditation interventions for both the medical and scientific community and specific populations of patients, as well as the larger community. This involves engaging medical professionals in meditative approaches to enhance their own well-being, teaching patients techniques to reduce stress levels associated with medical procedures and exacerbated by clinical symptoms, and sharing these resources in public forums.

The well-being techniques we teach and study are precise and scalable, making them well-suited to rigorous research with large populations. Many of our programs can also be personalized according to community need or designed specifically for particular health conditions. We collaborate with independent researchers and organizations to co-design interventions in various settings, including education, health care, athletic, corporate, public and more. We also offer mentorship to independent researchers exploring consciousness, cognition and compassion in different communities. As part of our mission, we welcome opportunities to bring our wellness tools to underserved populations across the globe. As our center moves into its second year, we are eager to further build long-term relationships and partnerships with experts from multiple disciplines all over the world.



### Team Members

(left to right in photo above)

- Akshaj Joshi, BA**  
Clinical Research Assistant
- Maria Gonçalves, PhD**  
Postdoctoral Research Fellow
- Isha Mishra, B Tech. MPH**  
Clinical Research Coordinator
- Shilpa Narayanan, BS**  
Clinical Research Coordinator
- Tanvi Khera, MD**  
Clinical Research Fellow
- Bala Subramaniam, MD, MPH, FASA**  
Professor of Anaesthesia  
Director, Sadhguru Center for a Consciousness Planet  
Ellison "Jeep" Pierce Chair of Anaesthesia at BIDMC
- Pooja Mathur, BA**  
Project Manager
- Preeti Upadhyay, MPH**  
Clinical Research Fellow
- Tulsi Chase, Ed.M.**  
Outreach and Education Manager
- Sepideh Hariri, PhD**  
Program Manager  
Instructor in Anaesthesia
- Shahla Siddiqui, MD, MSc**  
Assistant Professor of Anaesthesia
- Kestas Kveraga, PhD**  
Assistant Professor of Anesthesia
- Valluvan Rangasamy, MBBS**  
Instructor in Anaesthesia  
(not pictured above)

### Clinical Research

Our research is a blend of clinical interventions focused on improving postoperative recovery and cognitive health, particularly with older patients, and controlled breathing interventions that seek to improve general quality of life, mental health and awareness. All of our research is rigorously designed and firmly grounded in the scientific method, utilizing the expertise and experience of our faculty and collaborators.

### PANDORA

Delirium Prevention After Cardiac Surgery Using IV Acetaminophen to Prevent Postoperative Delirium in Older Cardiac Surgical Patients (PANDORA) is an NIH-funded clinical trial that launched in February 2020. The participating centers include Beth Israel Deaconess Medical Center, Brigham and Women's, Massachusetts General Hospital (MGH), Yale-New Haven Hospital, the University of Pittsburgh Medical Center, and the University of Alabama. Drs. Subramaniam, Marcantonio and Talmor are the lead investigators on the study.

This study investigates the impact of scheduled use of IV acetaminophen on the incidence, duration and severity of postoperative delirium and other important hospital outcomes. Additionally, this trial will evaluate the effects of IV acetaminophen on longer-term postoperative cognitive dysfunction and functional status and will develop a biorepository of perioperative samples as a future resource to probe the mechanisms of postoperative delirium.



## PATHFINDER

The PATHFINDER study (Perioperative Multimodal General Anesthesia Focusing on Specific CNS targets in Patients Undergoing Cardiac Surgeries) is a pilot study to confirm the feasibility of multimodal general anesthesia in high-risk cardiac surgery patients. The trial's goal was to observe and titrate the anesthesia regimen according to the guidance of electroencephalography neuromonitoring used during surgery. This targeted control approach during the intraoperative period resulted in stable hemodynamics in the operating room and smooth postoperative recovery. With the pilot study complete, the follow-up study, PATHFINDER 2, is underway to further expand and analyze the effects and benefits of multimodal anesthesia in a larger patient cohort.

## Delirium Biomarker

With the promising results found in the DexAcet pilot study, data analysis is underway to further understand the pathophysiology of delirium and perhaps its association with altered function of specific proteins. Using the samples collected from 120 patients during the trial, the goal of this study is to narrow down a group of biomarkers and assess their correlation to the occurrence of delirium. Through the usage of Ella multiplex assays, the study aims to identify proteins that may be directly indicative of delirium or may serve as diagnostic biomarkers in patients prone to delirium.

## PRIME-AIR

The PRIME-AIR (Positive End-Expiratory Pressure, Recruitment, Incentive Spirometry, Muscle-Relaxant Optimization, Preoperative Education, Postoperative Early Ambulation, Individualized and Reinforced) study is a prospective, multi-center, randomized controlled trial led by MGH, with a blinded assessor, to compare postoperative pulmonary complications and outcomes of patients with an individualized anesthetic-centered intervention (including individualized, mechanical ventilation positive end-expiratory pressure management to maximize respiratory system compliance and minimize driving pressures, a neuromuscular agent and subsequent reversal, and post-operative lung expansion and early mobilization) versus usual care.

## COVID-19 Yoga Study

This is a study on prevalence, protection and recovery from COVID-19 in seasoned yoga practitioners in comparison to age- and gender-matched controls. This is an analytic study with an observational arm of seasoned yoga practitioners, compared with age-, gender- and region-matched non-meditators as controls that are further randomized into active yoga group vs. placebo control group. The assessment is based on validated questionnaires on perceived stress, anxiety, depression, well-being, mindfulness, joy disposition and resilience in participants over the study duration.



## Faculty Experts



### Dr. Kestas Kveraga

is an Assistant Professor of Anaesthesia at Harvard Medical School (HMS). He received his PhD in

psychological and brain sciences at Dartmouth College and did a fellowship in neuroimaging at HMS and MGH. He previously held an appointment as assistant professor of radiology at HMS and was the director of the Visual Neurodynamics Lab at the Martinos Center for Biomedical Imaging. Kestas is a cognitive neuroscientist with expertise in brain imaging and recording techniques (MRI, MEG, EEG), visual psychophysics and eye- and limb-tracking. He is also skilled in brain connectivity analyses. At the Sadhguru Center, his research is focused on exploring meditation using neuroimaging and behavioral measurement techniques.



### Dr. Valluvan Rangasamy

received his MBBS from Stanley Medical College in India and his medical degree

from All India Institute of Medical Sciences in New Delhi, where he also did his residency in anesthesiology. He pursued higher-level training in the U.K. and served as a senior registrar in a Department of Anesthesia and Intensive Care there, where he was involved in high-risk surgeries, obstetric, anesthesia and critical care. Dr. Rangasamy completed a clinical fellowship with our department in 2019. He is active in clinical research as well in areas such as perioperative outcomes, hemodynamics and frailty.



**Dr. Shahla Siddiqui** is an Assistant Professor of Anaesthesia at Harvard Medical School (HMS). She received her medical degree from Aga Khan

University in Pakistan and her MSc in medical ethics from the University of Singapore, and did her anesthesia residency at the University of Maryland and a critical care fellowship at Columbia University. In addition to her clinical work, she has had an active research career and has many areas of interest, including interprofessional education, health-science qualitative research, ICU burnout and sepsis in the ICU. She is also very interested in medical ethics and related topics such as compassion in medicine, an area where she has several active projects.



### Dr. Sepideh Hariri

received her PhD in physics with a research focus in biophysics and medical imaging from the University of Waterloo in Ontario,

Canada, in 2013. Since then, she has been an active educator and researcher. Sepideh's research has enhanced the imaging capability of optical coherence tomography in retinal imaging and explored early markers of retinal degeneration. During the past three years, she shifted her research focus and has been collaborating with researchers from Rutgers University, Indiana University and BIDMC on the impact of contemplative practices on well-being. At the Sadhguru Center, Sepideh works with her colleagues in research on meditation in relation to consciousness, cognition and compassion.

## IEO S2Tech Study

This is a waitlisted, randomized controlled trial aimed at studying the effects of Inner Engineering Online (IEO), an online course imparting information on meditation and yoga practices. The study aims to look at the effect of IEO on stress, burnout and well-being measures of employees of a specific IT company by employing validated questionnaires. The study's results validated the importance of participant adherence to study protocol and the impact compliance has on the perceived stress scales (primary outcome) in the study.

## Stress and Well-Being in Nurses During the COVID-19 Pandemic

Nurses are the torchbearers of compassionate care in the medical system. Their physical, mental and emotional health has been on the downswing according to the statistics and has declined significantly during the COVID pandemic. In this randomized controlled study, we aim to investigate the impact of a comprehensive online wellness program (Inner Engineering) on nurses' well-being using standard surveys, blood biomarkers and neuroimaging techniques. Our preliminary data from other studies have shown a significant improvement in participants' mental and emotional well-being as a result of this intervention.

## Green Light for Meditation

Meditation is associated with enhanced overall well-being, improved mental capability and emotional balance. However, the mechanisms of these effects are not fully understood. Moreover, it often takes much practice and dedication for a novice to become proficient with a particular type of meditation and experience a meditative state for a sustained duration of time. This can become a deterrent for a large segment of the population to reap the many benefits of meditation. Inspired by the discovery of the positive impact of green light on migraine headache by Dr. Rami Burstein at BIDMC, this study investigates the possible impact of this narrow spectrum of green light on the quality of meditation in both novice and experienced meditators using behavioral measures and neuroimaging techniques.

## Long COVID Breathing & Wellness Program

In collaboration with BIDMC Critical Illness and COVID-19 Survivorship Program led by Dr. Jason Maley, SCCP is now launching a pilot clinical trial to investigate the impact of this therapeutic program on the neuropsychological outcomes, breathing discomfort, somatic symptoms and quality of life in COVID long patients. The result of this study will provide the foundation for future larger clinical trials and can help guide



successful implementation of low-cost, low-risk mind-body interventions into long COVID management and treatment protocols. The practices in this program were proposed by Dr. Subramaniam to Dr. Maley to support Long COVID patients in their recovery. These patients at BIDMC were referred to SCCP's intervention, which is conducted by 1750-hour certified classical yoga teachers trained at the prestigious Isha Hatha Yoga School. Preliminary findings show that patients have reported significant improvement in their symptoms.

### Meditation and Sleep: Investigating Sleep Architecture and Implications

Sleep is an extremely crucial aspect of human physiology and is very important for our health. Statistics show an increasing trend in insufficient sleep and poor quality of sleep in all age groups and demographics in the United States, which can lead to many chronic health issues. Meditation practices are associated with improved quality of sleep and enhanced experience of restfulness, which in turn can improve one's alertness and performance during wakefulness. In this study, we will investigate the impact of a 15-minute meditation compared to nap to better understand sleep architecture as well as the mechanism of how meditation can improve sleep.

### Compassionate Care in the ICU

There is a decreasing state of compassion in health systems across developed countries. Compassion is the recognition, empathic understanding of and emotional resonance with the concerns, pain, distress or suffering of others coupled with motivation and relational action to ameliorate these conditions. This will be a survey of ICU clinician members of the Society of Critical Care Medicine and the European Society of Intensive Care Medicine using a modified version of the Schwartz Compassionate Care Scale for self-assessment. This will give us a broader understanding by eliciting free text comments on three ICU case vignettes and a focus group discussion of a few volunteers to discuss determinants of lack of compassion such as systemic bias. Finally, we will analyze the results and develop a curriculum to assess and teach compassion in the ICU.

### Grants and Funding

Title: Delirium Prevention After Cardiac Surgery Using IV Acetaminophen to Prevent Postoperative Delirium in Older Cardiac Surgical Patients (PANDORA)  
Funded by: NIH National Institutes of Aging  
Dr. Balachundhar Subramaniam (PI)

Title: An Anesthesia-Centered Bundle to Reduce Postoperative Pulmonary Complications: The PRIME-AIR Study (PRIME-AIR)  
Funded by: NIH National Heart, Lung and Blood Institute  
Dr. Balachundhar Subramaniam (Co-PI)

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Azimaraghi O, Hammer M, Santer P, Platzbecker K, Althoff FC, Patrocino M, Grabitz SD, Wongtangman K, Romyantsev S, Xu X, Schaefer MS, Fuller PM, Subramaniam B, Eikermann M. **Study Protocol for a Randomised Controlled Trial Evaluating the Effects of the Orexin Receptor Antagonist Suvorexant on Sleep Architecture and Delirium in the Intensive Care Unit.** *BMJ Open.* 2020. PMID: 32690536

Fernandes MPB, Armengol de la Hoz M, Rangasamy V, Subramaniam B. **Machine Learning Models with Preoperative Risk Factors and Intraoperative Hypotension Parameters Predict Mortality After Cardiac Surgery.** *J. Cardiothorac. Vasc. Anesth.* 2020. PMID: 32747203

O'Gara B, Marcantonio ER, Mueller A, Shaefi S, Banner-Goodspeed V, Subramaniam B. **Prevention of Early Postoperative Decline: A Feasibility Study.** *Anesth. Analg.* 2020. PMID 31569161

Packiasabapathy S, Prasad V, Rangasamy V, Popok D, Xu X, Novack V, Subramaniam B. **Cardiac Surgical Outcome Prediction by Blood Pressure Variability Indices Poincare Plot and Coefficient of Variation: A Retrospective Study.** *BMC Anesthesiol.* 2020. PMID 32126969

Rangasamy V, de Guerre L, Xu X, Schermerhorn ML, Novack V, Subramaniam B. **Association Between Intraoperative Hypotension and Postoperative Adverse Outcomes in Patients Undergoing Vascular Surgery: A Retrospective Observational Study.** *J. Cardiothorac. Vasc. Anesth.* 2020. PMID: 33293215.

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Sadhasivam S, Alankar S, Maturi R, Vishnubhotla RV, Mudigonda M, Pawale D, Narayanan S, Hariri S, Ram C, Chang T, Renschler J, Eckert G, Subramaniam B. **Inner Engineering Practices and Advanced 4-Day Isha Yoga Retreat are Associated with Cannabimimetic Effects with Increased Endocannabinoids and Short-Term and Sustained Improvement in Mental Health: A Prospective Observational Study of Meditators.** *Evid. Based Complement. Alternat. Med.* 2020. PMID: 32595741

Shaefi S, Shankar P, Mueller AL, O'Gara BP, Spear K, Khabbaz KR, Bagchi A, Chu LM, Banner-Goodspeed V, Leaf DE, Talmor DS, Marcantonio ER, Subramaniam B. **Intraoperative Oxygen Concentration and Neurocognition After Cardiac Surgery.** *Anesthesiology.* 2020. PMID: 33331902

Subramaniam B, Shankar P, Shaefi S, Mueller A, O'Gara B, Banner-Goodspeed V, Gasangwa D, Patxot M, Packiasabapathy S, Mathur P, Eikermann M, Talmor D, Marcantonio ER. **Effect of Postoperative Intravenous Acetaminophen Versus Placebo, Combined with Propofol or Dexmedetomidine, on Postoperative In-Hospital Delirium Among Older Patients Following Cardiac Surgery: The DEXACET Randomized Clinical Trial.** *JAMA.* 2019. PMID: 30778597

Title: Biomedical Informatics Tools for Applied Perioperative Physiology  
Funded by: NIH National Institute of Biomedical Imaging and Bioengineering  
Dr. Balachundhar Subramaniam (Co-PI)

Title: Sadhguru Center for a Conscious Planet  
Funded by: Philanthropy

Title: Incorporating Routine Assessment of Frailty Using a Multidimensional Frailty Assessment Tool (FRAIL-MD) During the Perioperative Period  
Funded by: Department of Anesthesia, Critical Care and Pain Medicine  
Dr. Valluvan Rangasamy (PI)

Title: Compassionate Care in the Intensive Care Unit  
Funded by: Department of Anesthesia, Critical Care and Pain Medicine  
John Hedley-Whyte Faculty Development Fellowship  
Dr. Shahla Siddiqui (PI)

### Education

Education and community outreach are major components of the Sadhguru Center's effort to bolster well-being and compassion in our community, nation and around the world. We create and disseminate many types of resources aimed toward improving the mental and physical health of patients and providers and enhancing quality of life for all. One of our most successful educational initiatives is a series of webinars that provide a venue for discussions between contemplative scholars and experts in medicine and science. These webinars have garnered over four million viewers worldwide and have explored topics such as Leadership Dilemmas in Health Care During the COVID-19 Crisis, Mental Health Pandemic, Compassion Cannot Choose—Health Care Disparities, Memory, Consciousness and Coma and Mind and Brain.

The Sadhguru Center also plans to bring together experts across multiple disciplines for annual conferences to share its work and explore new ideas. These experts will include health care practitioners, contemplative scholars, experts in neuroscience and consciousness, as well as the general public. In addition, we are planning workshops to provide support and strategies for patients and their families to manage stress levels, as well as enhance quality of life. This effort includes programs for medical providers that will allow them to offer patients meditative approaches to improve their physical and emotional states of mind during critical illness and surgical procedures as well as in their daily lives.

In a further effort to reach caregivers, we conduct outreach to the medical and scientific community, medical trainees, students and the general public. Our plans include teaching meditative techniques to medical students, teaching patients relaxation techniques and publishing preventive resources in public forums. These educational efforts give us the opportunity to share our proven wellness-enhancing methods as widely as possible and can promote awareness and compassion around the world.

#### Websites

- **Sadhguru Center for a Conscious Planet:**  
<https://www.bidmc.org/research/research-by-department/anesthesia-critical-care-and-pain-medicine/research-centers/sadhguru-center>
- **PANDORA:**  
[www.pandoraclinicaltrial.org](http://www.pandoraclinicaltrial.org)
- **PEARL:**  
<https://projects.iq.harvard.edu/subramaniamresearchlab/home>





## Mentorship

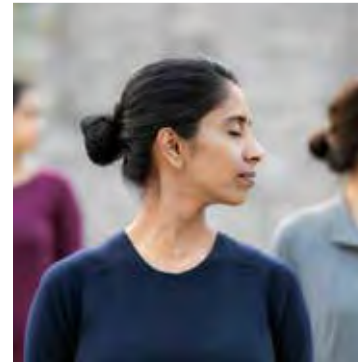
### Our Advisors

- Dr. Akshay Anand, PhD, Professor of Neurology, Post-Graduate Institute of Medical Education and Research (PGIMER), Chandigarh, India
- Dr. Kanwaljeet J. S. Anand, MBBS, DPhil, FAAP, FCCM, FRCPC, Professor of Pediatrics, Anesthesiology, Perioperative and Pain Medicine at Stanford University School of Medicine, Stanford, CA
- Dr. Emery N. Brown, MD, PhD, Edward Hood Taplin Professor of Medical Engineering, Institute for Medical Engineering and Science, Professor of Computational Neuroscience, Picower Institute for Learning and Memory, Department of Brain and Cognitive Sciences, Massachusetts Institute of Technology, Warren M. Zapol Professor of Anaesthesia, Harvard Medical School, Department of Anesthesia, Critical Care and Pain Medicine, Massachusetts General Hospital
- Dr. Samuel M. Brown, MD, Associate Professor of Critical Care Medicine and Medical Ethics and Humanities, University of Utah School of Medicine, UT
- Greg Hammer, MD, Professor of Anesthesiology, Stanford University Medical Center, Stanford, CA
- Dr. Steven Laureys, MD, PhD, FEAN, Director, “Giga Consciousness” Research Unit and “Coma Science Group,” Professor, Center du Cerveau2, University Hospital of Liège, Liège, Belgium
- Dr. Nancy E. Oriol, MD, Associate Professor of Anaesthesia, Harvard Medical School
- Dr. David Vago, PhD, Director of Contemplative Neurosciences and Mind-Body Research Laboratory, Associate Professor, Department of Psychology, Vanderbilt Brain Institute, Vanderbilt University, Nashville, TN
- Dr. Simon C. Robson, MD, PhD, Charlotte F. and Irving W. Rabb Professor of Medicine at Harvard Medical School
- Dr. Rami Burstein, PhD, John Hedley-Whyte Professor of Anaesthesia, Harvard Medical School, Vice Chair, Anesthesia, Critical Care and Pain Medicine Research, Beth Israel Deaconess Medical Center

## Conclusion

Our center’s ultimate goal is to use our work to enhance consciousness and cognition of patients, clinicians and the general public to improve patient care, outcomes and quality of life for all. Merging the strengths of science and spirituality is the need of the hour, and this approach enables us to more fully foster physical, mental and emotional well-being for all. It also enables us to provide insight into the mechanism of how consciousness, cognition and compassion are aided by meditative practices.

This past year was a challenging one, with the deadly COVID-19 pandemic ravaging our communities. We envision our work as a source of healing and positive impact on the holistic health and overall thriving of our health care providers, medical staff and community members for decades to come. Ultimately, as we continue to fulfill our mission, we look forward to helping create a much-needed positive transformation in the world.





# The Valve Research Group



**Feroze-Ud-Den Mahmood, MBBS**  
 Director, Cardiac Anesthesia  
 Director, Perioperative Echocardiography  
 Professor of Anaesthesia

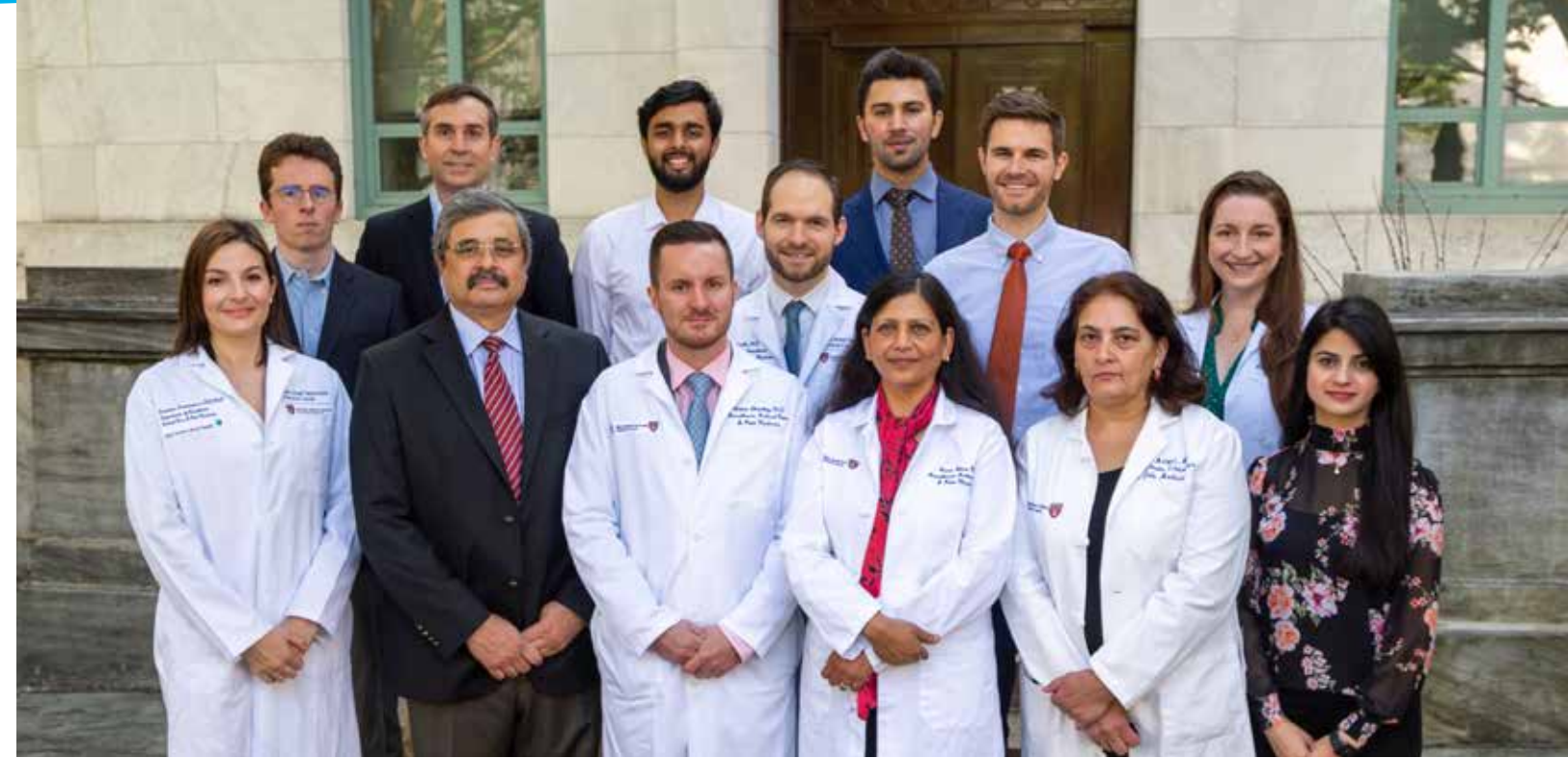


**Robina Matyal, MBBS**  
 Director, Vascular Anesthesia  
 Leonard Bushnell Chair of Anaesthesia  
 at BIDMC  
 Associate Professor of Anaesthesia

The Valve Research Group at the Beth Israel Deaconess Medical Center (BIDMC) Department of Anesthesia, Critical Care and Pain Medicine, led by Dr. Feroze Mahmood and Dr. Robina Matyal, offers one of the most well-known ultrasound training programs in the world. Our department was a pioneer in adopting transesophageal echocardiography (TEE) technology in the mid-1990s. Since the late 1990s, perioperative TEE service has been recognized as a standalone division offering TEE monitoring services during the perioperative period. Our group has expanded the TEE program to the use of point-of-care ultrasound in the perioperative arena.

The Echo Lab, a section of the Valve Research Group located on the fourth floor of the Rosenberg building, is the center of echocardiography/ultrasound operations. Besides echocardiography-related research, it is also the hub of our perioperative ultrasound education program and houses our three dimensional (3D) printing laboratory and robust simulation training. As a result of the ingenuity and initiative of our educational division, our laboratory was one of the first pioneers to introduce TEE and transthoracic echo (TTE) derived 3D printing, virtual reality simulator education in echocardiography, point-of-care ultrasound and regional anesthesia education. In addition to Harvard Medical School's accredited continuing medical education programs, the Valve Research Group offers multiple TEE, TTE and point-of-care ultrasound training programs to trainees from other departments within the medical center and regionally. Thanks to continuing departmental and hospital support, we have a diverse portfolio of the latest 3D echocardiography equipment for our residents and fellows. With the ever-expanding scope of structural heart programs, we are the sole providers of echocardiographic guidance for structural heart interventions, with dedicated faculty assignments at BIDMC. Additionally, our laboratory is identified as the hospital's core 3D-printing facility, providing 3D-printing services to the entire medical center.

*“It had long since come to my attention that people of accomplishment rarely sat back and let things happen to them. They went out and happened to things.” —Leonardo da Vinci*



## Members

- Aidan M. Sharkey, MD**  
Instructor in Anaesthesia
- Ruma R. Bose, MD, MBBS**  
Assistant Professor of Anaesthesia  
Program Director, Adult Cardiothoracic Fellowship
- John D. Mitchell, MD**  
Associate Professor of Anaesthesia  
Vice Chair, Education  
Director, Center for Education Research and Innovation
- Huma Fatima, MD**  
Research Fellow
- Omar Chaudhary, MD**  
Research Assistant
- Nada Qaiser Qureshi, MD**  
Research Fellow
- Syed Hamza Mufarrih, MD**  
Research Fellow
- Vincent Baribeau, BS**  
Research Assistant

## COVID-19

In order to adhere to social-distancing constraints related to the COVID-19 pandemic, our group initiated an e-learning project to transform resident education into a continuous, bidirectional and highly interactive experience. Using state-of-the-art software, multiple e-learning modules were created by members of our group to be utilized by trainees and faculty in their own space, pace and time. In the context of the ongoing pandemic, their scope encompasses interactive training modules for clinical use of perioperative ultrasound as a diagnostic and monitoring tool and as a procedural adjunct. A few of these modules (arterial line, central placement) were introduced as “My Path” modules for health care providers over the entire Beth Israel Lahey Network. While this was meant to address the disruption in education, our e-learning program has evolved into a standalone education project (<http://ultrasoundcentral.com>). We continue to develop and refine the program and plan to introduce this educational product to an international audience. We include some of the e-learning modules below:

- Guided Confirmation of Central Line Placement
- Ultrasound-Guided Lung Evaluation
- Ultrasound-Guided Arterial Line Placement
- Evaluation of Pericardial Effusion
- Right Ventricle Assessment
- Gastric Ultrasound: Evaluation of Aspiration Risk
- Three-Dimensional Imaging Workshop
- Management of Cerebrospinal Fluid Drain
- Simplified Algorithm for Evaluation of Perioperative Hypoxia and Hypotension (SALVATION)



In the context of the pandemic, we have also introduced another pilot training program for clinical use of the ultraportable Butterfly Ultrasound. This affordable point-of-care ultrasound product, allows web-based storage of ultrasound images and enables real-time expert consult and feedback. In addition, using the proprietary link, experts can provide real-time imaging guidance in probe manipulation and image optimization and obviate the need for physical presence of the instructor.

## Structural Heart Interventions

Our group is part of multiple national trials investigating use of percutaneous devices for structural valvular disorders. Of note, members of our group are among the principal investigators of the ongoing Edwards PASCAL Transcatheter Mitral Valve Repair System Study (CLASP). We are piloting a multidisciplinary program to introduce intracardiac echocardiography during structural heart interventions along with development of structural heart disease simulators. Our department will be the first in the country to offer this training. We have the distinction of developing the first Structural Heart Disease fellowship for cardiac anesthesiologists. We have graduated our first fellow, and are proud that the program is gaining national and international attention. Additionally, members of the group are in the process of resurrecting the Boston Echo Course, which was one of the leading echocardiography courses in the country and has been in hiatus for a few years. This version will be a focused structural heart disease course with a significant hands-on component. We plan to start this course in spring of 2021.



## Navy combat medics learn ultrasound from BIDMC CERTAIN and Valve Research Teams

Our Center for Education Research, Technology, and Innovation (CERTAIN) and Echo Lab Valve Research Group led a week-long training at BIDMC for special-forces medics that taught skills to perform ultrasound assessments on the battlefield. This course, “Ultrasound for Navy Combat Medics,” trained to do ultrasounds on the heart, lungs, and abdomen, place venous catheters, and provide regional anesthesia. After completing an online curriculum, the medics attended live sessions, including lectures, case-based discussions, and hands-on sessions on simulators and live models — all led by our volunteer teams of instructors. The simulation sessions included advanced hand- and probe-motion metrics to provide feedback and improve skills by identifying areas for improvement. After the course ends, the team will follow and provide support to participants and their colleagues so their fluency in these techniques continues to improve.

Derek Lodico, DO, former BIDMC Fellow in Cardiothoracic Anesthesia and Dive Medical Officer in the U.S. Navy, helped facilitate the course on the navy end and was thrilled at the outcome. He commented:

“This was the first time a Navy Medic has been put through such an extensive point-of-care



ultrasound training course. It's also the first time regional anesthesia training has been implemented in the military outside of physicians. Our goal is to outfit the Navy medics going into harm's way with the skills they need to manage combat trauma and save lives. This course not only accomplished this, but also trained them to a level allowing for this team to go home and teach other medics. The biometric feedback given on a daily basis allowed the medics to excel in skill acquisition beyond what we expected.”

CERTAIN Director Dr. John Mitchell was thrilled with the outcome of the course and plans to continue similar sessions in the future, saying:

“This intensive week of training provided advanced biometric feedback from both simulators and live models throughout the course in an effort to speed skill acquisition. Additionally, it taught these Navy combat medics critical skills at a high level in a manner which we believe will improve retention over time. We will continue to follow and provide educational support to these participants and their colleagues and expect their fluency with ultrasound to continue to accelerate.”

## Basic Research

The Valve Research Group has a very robust basic science research program focused on diabetic cardiomyopathy and microvascular coronary artery disease. Small animal experiments are conducted in our laboratory at the Center for Life Sciences. Currently there are multiple projects underway relating to nanoparticle-based remote delivery of angiogenic molecules for microvascular growth, pathophysiology of post-cardiac surgical atrial fibrillation and gender-based differences in diabetic cardiomyopathy. Specifically, our group has investigated elements of the underlying molecular pathophysiology of women's heart disease, specifically in association with heart failure with preserved ejection fraction (HFpEF). Our hypothesis is that there are central roles of purinergic and linked neuropeptide pathways in control of angiogenesis and mitochondrial activity which are disordered in the setting of estrogen loss and the development of insulin resistance and metabolic syndrome, resulting in microvascular disease and HFpEF. Moreover, currently we are exploring gender-based differences in heart failure and altered adenosinergic responses in the setting of postmenopausal estrogen deficiency along with the translational implications via a pharmacological ADORA A(2a) agonist. We will identify specific pathways involved in estrogen-dependent adenosine signaling during ischemia. In addition, we have investigated and published regarding the role of decreased autophagy in diabetic myocardium.

## Clinical Research

With the multidisciplinary scope of operation of the Valve Research Group, a multispecialty group of clinical collaborators (anesthesia, cardiology, cardiac surgery) design and conduct clinical research and develop innovative therapies for cardiovascular disease.

## Educational Research

The members of our group completed an exciting study to objectively evaluate proficiency level in the use of perioperative ultrasound using a composite “proficiency index” they conceived and developed. This project was recently completed as part of our Foundation for Anesthesia Education and Research (FAER) grant. Using this index, programs can now track skill progression in trainees and customize and individualize instruction. In collaboration with Dr. John Mitchell and the CERTAIN group as well as the Department of Radiology, we have initiated a project in which, using hand-motion sensors, we perform kinematic analyses to identify motion characteristics that identify and predict achievement of proficiency by intern-level trainees—as well as in a cohort of Navy SEALs.



**SELECTED PUBLICATIONS**

Baribeau Y, Bortman J, Khamooshian A, Laham R, Mahmood F, Mahmood F, Sharkey A, Steely A, Matyal R. **A 3-Dimensionally Printed, High-Fidelity Ultrasound-Guided Pericardiocentesis Training Model.** *J. Cardiothorac Vasc. Anesth.* 2019. PMID: 31558396

Chaudhary O, Baribeau Y, Urits I, Sharkey A, Rashid R, Hess P, Krumm S, Fatima H, Zhang Q, Gangadharan S, Mahmood F, Matyal R. **Use of Erector Spinae Plane Block in Thoracic Surgery Leads to Rapid Recovery from Anesthesia.** *Ann. Thorac. Surgery.* 2020. PMID: 32442622

Chaudhary O, Sharkey A, Schermerhorn M, Mahmood, F, Schaefer M, Bose R, Pannu A, Fatima H, Baribeau Y, Krumm S, Soden P, Thomas A, Cassavaugh J, Rashid R, Matyal R. **Protocolized-Based Management of CSF Drains in TEVAR Procedures.** *Ann. Vasc. Surgery.* 2020. PMID: 32927046

Mahmood E, Bae S, Chaudhary O, Zhang Q, Feng R, Mahmood F, Rashid R, Robson S, Lee D, Kang P, Matyal R. **Neuropeptide Y3-36 Incorporated into PVAX Nanoparticle Improves Angiogenesis in a Murine Model of Myocardial Ischemia.** *Eur. J. Pharmacology.* 2020. PMID 32534073

Neves SE, Fatima H, Walsh DP, Mahmood F, Chaudhary O, Matyal R. **Role of Ultrasound-Guided Evaluation of Dyspnea in the Coronavirus Disease 2019 Pandemic.** *J. Cardiothorac. Vasc. Anesth.* 2020. PMID 32737001

Sharkey A, Mahmood F, Matyal R. **Diastolic Dysfunction—What an Anesthesiologist Needs to Know?** *Best Pract. Clin. Anaesthesiol. Res.* 2019; PMID: 31582101

Walsh DP, Murugappan KR, Oren-Grinberg A, Wong VT, Mitchell JD, Matyal R. **Tool to Improve Qualitative Assessment of Left Ventricular Systolic Function.** *Echo Res. Practice.* 2020. PMID: 32190341

Zhang Q, Feng R, Chaudhary O, Mahmood E, Baribeau Y, Rashid R, Khabbaz K, Chu L, Liu D, Senthilnathan V, Cassavaugh J, Mahmood F, Robson S, Matyal R. **Cardiopulmonary Bypass Suppresses FOXO3a Activation and Downstream Autophagy in Diabetic Human Heart.** *Ann. Thorac. Surgery.* 2020. PMID 32712101

**Three-Dimensional Imaging**

Our medical center has been a leader in the application of deep-learning algorithms based on artificial intelligence (AI). Our group has demonstrated and published the feasibility of using AI for the geometric analyses of aortic and mitral valves and the right ventricle. In collaboration with engineers, we have also developed an AI-based geometric analysis of the tricuspid valve, which is the first-of-its-kind software for tricuspid valve assessment. Our ongoing project of mitral valve analysis continues to grow, and we are in the process of defining a structural “mitral valve reserve” that can be used as an index for patient selection for valve repair over replacement in ischemic mitral regurgitation.

**Quality Improvement Projects**

To improve perioperative outcomes in patients undergoing video-assisted thoracoscopic surgery, we compared erector spinae plane (ESP) blocks with intercostal blocks (ICB) as part of multimodal analgesia in the quality of postoperative pain control and preservation of pulmonary function. Our next goal is to evaluate the efficacy of ultrasound-guided ESP block as an adjuvant for perioperative pain management and lung preservation in patients undergoing cardiac surgery. Through multidisciplinary collaboration, our group created a standard of practice for the selection, ultrasound-guided placement and management of lumbar drains in high-risk vascular surgeries. This has been adopted and distributed across the Beth Israel Lahey network and published in a vascular surgery journal. We have created a multidisciplinary, standardized practice approach to streamline the implementation of an abdominal aortic aneurysm rupture protocol. These clinical innovations have made the procedures smoother, decreased complication rates and improved outcomes. Additionally, we developed a standard of practice for peripheral nerve catheters to optimize analgesia in patients undergoing lower-extremity amputations and demonstrated improved outcomes with this modality.

**Database Research Projects**

With access to national databases, the research fellows are involved in outcome-related statistical projects. Our projects have focused on gender-based differences seen in post-operative outcomes after coronary artery bypass graft (CABG) along with the impact of left atrial appendage exclusion in isolated CABG. In addition, we have evaluated the rate of pulmonary complications and 30-day mortality after regional versus general anesthesia in patients undergoing lower-extremity amputation at a national level.

**Research Studies**

Title: Gender-Based Study Assessing the Role of Estrogen in Age-Associated Changes of the Heart  
Funded by: Department of Anesthesia, Critical Care and Pain Medicine, BIDMC  
Dr. Robina Matyal (PI)

The goal of this study is to explore elements of the underlying molecular pathophysiology of women's heart disease, specifically in association with HFpEF.

**Conclusion**

With the collective hard work and dedication of our members, the Valve Research Group has distinguished itself as one of the premier ultrasound, echocardiography and 3D imaging centers in the world. We have a unique and productive multidisciplinary collaborative operation that continues to thrive in a culture of excellence. In the last decade, our group has made clinical innovations that have led to a significant positive impact on patient-management protocols. The novel procedures we have brought to the bedside were once considered bench-only techniques. In particular, use of TEE for non-cardiac surgery and geometric assessment of the mitral annulus and 3D printing have the potential to revolutionize the management of high-risk patients undergoing cardiac and non-cardiac surgery. We have pioneered the revolutionary concept of anesthesiologists as experts in perioperative ultrasound and will very likely change the scope of practice of clinical anesthesiology.





# Selected Faculty Publications

July, 2019 – June, 2021

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# Residents & Fellows

## 2020 Graduates

### Residents

Tahir Ahmed, MD, PhD  
 John Bordlee, MD  
 Maria Borrelli, DO  
 Philip Chan, MD  
 Justin De Biasio, MD  
 Austin DeBeaux, MD\*  
 Adeel Faruki, MD  
 Sarah Fieber, MD  
 Hebah Ismail, MD, JD  
 Mark Jones, MD  
 Jay Lee, DO  
 Daniel McGrail, MD\*  
 Mario Montealegre Gallegos, MD  
 Ronny Munoz Acuna, MD  
 David Porbunderwala, MD  
 Priya Ramaswamy, MD, MEng  
 Syena Sarrafpour, MD  
 Janna Taylor, MD\*  
 Chiedozie Uwandu, MD

\* Chief Resident

### Fellows

#### ADULT CARDIOTHORACIC ANESTHESIA

Arkadi Beloiartsev, MD  
 John Kaminski, MD  
 Katerina Wilson, MD

#### STRUCTURAL HEART

Kiran Belani, MD

#### REGIONAL ANESTHESIA

Patrick Olsen, DO

#### CRITICAL CARE

Sean Baskin, DO  
 Andre Fiche Gosling, MD  
 Kaarin Michaelsen, MD, PhD

#### NEUROCRITICAL CARE

Andres Brenes Bastos, MD

#### OB ANESTHESIA

Lindsay Sween, MD, MPH

#### PAIN MEDICINE

Emily Bouley, MD  
 Connie Bruno, MD  
 Gabriela Calhoun, MD  
 Moshe Chinn, MD  
 Jamal Hasoon, MD  
 Luke Law, MD  
 Ivan Urits, MD

#### ANESTHESIA FOR AMBULATORY SURGERY

Salameh Obeidat, MD

#### HMS RESEARCH FELLOWSHIP

Yanick Baribeau, BS  
 Omar Chaudhary, MD  
 Quanqian Zhang, MD  
 Shuo Liu, MD

## 2021 Graduates

### Residents

Rabia Amir, MD  
 Allison Basel, MD  
 John Bellamente, MD  
 Omar Elmadhoun, MD, MPH  
 Alexander Gutierrez, MD  
 Stephan Hain, MD  
 Allison Hyatt, MD  
 Joseph Kalet, MD\*  
 Gregory Kirby, MD\*  
 Juan Li, MD  
 David Melton, MD, PhD  
 Meera Ramsooksingh, MD, MS  
 Ankita Satpute, MD  
 Warren Southerland, MD  
 Steven Young, MD  
 Jinhui Zhao, MD, MPH\*

\* Chief Resident

### Fellows

#### ADULT CARDIOTHORACIC ANESTHESIA

Sean Baskin, DO  
 Dan McGrail, MD  
 David Porbunderwala, MD  
 Janna Taylor, MD

#### STRUCTURAL HEART

Anastasia Katsiampoura, MD, PhD

#### REGIONAL ANESTHESIA

John Bordlee, MD

#### CRITICAL CARE

Philip Chan, MD  
 Annette Ilg, MD  
 Mario Montealegre Gallegos, MD

Ronny Munoz Acuna, MD

#### OB ANESTHESIA

Maria Borelli, DO

#### PAIN MEDICINE

Tahir Ahmed, MD, PhD  
 Keisha Dodman, MD  
 Ken Ehrhardt, MD  
 Yuel Kia Jean, DO  
 Syed Mahmood, MD  
 Syena Sarrafpour, MD  
 Chiedozie Uwandu, MD

#### PERIOPERATIVE QUALITY & SAFETY

Nadav Levy, MD  
 Liana Zucco, MBBS, FRCA

#### ADVANCED PERIOPERATIVE ULTRASOUND & CLINICAL FELLOWSHIP

Santiago Krumm Cabezas, MD

#### HMS RESEARCH FELLOWSHIP

Tanvia Khera, MBBS, MD  
 Preeti Upadhyay, MBBS, MPH



2021 Graduating Residents



2021 Graduating Fellows



# Team Lists

## BIDMC Nurse Practitioner Team

- Ashley Lowery, RN, AGNP-BC**  
Clinical Manager, Advanced Practice Providers; Periop
- Yun Young Bae, NP**  
Periop
- Regina Champagne, NP**  
Regional Acute Pain Service
- Joelle Chateauf, NP**  
PAT
- Laura Cook, NP**  
Periop
- Sara Durgerian, NP**  
PAT
- Nicole Epolito, NP**  
PAT
- Emilia Evans, NP**  
Periop
- Ina Harten, NP**  
Periop
- Bryar Hasenjaeger, NP**  
PAT
- Brian Hoell, NP**  
PAT
- Caitlin Hussey, NP**  
Headache Clinic
- Laura Kenney, NP**  
Periop
- Joyce Larson, NP**  
PAT
- Josephine Mattsson, NP**  
Periop
- Mary-Ellin Moore, NP**  
PAT
- Devon O'Connell, NP**  
Periop
- Peguy Philemon, RN**  
ECT, GI3, CV
- Laura Ricercato, NP**  
Periop
- Katrina Robertson, NP**  
BID-Needham Pain Clinic
- Virginia Sheppard, NP**  
PAT
- Eileen Stuart-Shor, RN, AGNP-BC, PhD**  
PAT



Periop Nurse Practitioner Team



PAT Nurse Practitioner Team with Division Director, Dr. Pollard (center)

## BIDMC Anesthesia OR Technician Team

Anesthesia OR Technician Team



- Ed Plant, CE**  
Technical Director
- Tom Malboeuf, Cer.AT**  
Clinical Manager
- Martin Manning**  
BMET Specialist
- Bejan Abaspour**  
CE Specialist
- Tom Xie, MS**  
Manager of Anesthesia IT Operations
- Rob Ruiz**  
AIMs Technical Analyst-I
- Jobe Diagne**  
AIMs Technical Analyst-I

### West Campus Team

- Edwardo Santiago**  
Lead Technician
- Desinor Dely**
- Anson Harrison**
- Claudia Platero-Arias**
- Carolina Swarton**
- James Thomas**

### Cardiac Team

- Frantz Gilbert**  
Cardiac Lead Technician
- Jessica Crehan**  
Cardiac Tech
- Heather Carroll**  
Cardiac Tech
- Emmett Geraghty**  
Cardiac Tech
- Jason Tolman**  
Cardiac Tech

### East Campus Team

- Agnes Clermont**  
Lead Technician
- Elvira Clarke**
- Skip Kitchen Jr.**
- Nick Rami**
- Derick Sealy**
- Edlin Silcott**
- Tammy Staffier**
- Jannette Stephenson**



## Arnold – Warfield Pain Center Team

**Juanita Brown**  
Practice Manager

### Administrative Assistants

**Colleen Michaels-Walsh**

**Ashley McCarter**

**Christina Nkrumah-Appiah**  
BID-Milton Pain Clinic

**Sandra Avendano**  
BID-Needham Pain Clinic

### Revenue Cycle Coordinators

**Vittaya Jaraskul**  
Rev Cycle Supervisor

**Sandy Barbosa**  
Managed Care Coordinator

**Aduapemi Benson**  
Managed Care Coordinator

**Earlena Williams**  
Out-Patient Pain Specialist

### Clinical Practice Assistants

**Cynthia Columbus**

**Wesnaica Jean Pierre**

**Katelyn Steeves**

**Anita Wood**

### Patient Services Representatives

**Claudia O. Beauvais**

**Heather Lane**

### Practice Representatives

**Wanda Hunt**

**Jo-Ann Martell**

**Franchesca Ortiz**

### Practice Coordinator

**Melissa Egan**

### Nursing

**Elizabeth Carvelli, RN, DNP**  
Nursing Director

**Katherine P. Boyle, RN**

**Joanne Cullen, RN**

**Susan B. Dwyer, RN**

**Marian A. George, RN**

**Patricia A. Smith, RN**

## Anesthesia Financial Solutions, LCC Team

**Shannon Cameron, MBA, MHIIM, CPC**  
Executive Director of Revenue Cycle

**Steven Bailey**  
Senior Billing Associate

**Aaron Banner-Goodspeed**  
Senior Manager Revenue Integrity

**Tracy Blake, CCS-P**  
Senior Manager of Operations & Human Resources

**Candice Morgan**  
Billing Associate

**Jessica Duffy, CPC, CANPC**  
Coding Analyst

**Nicole Ellison**  
Billing Associate

**Clinton Evans**  
Billing Associate

**Lindsay Forecast**  
Team Lead, Chart Acquisition

**Omar Grey**  
Billing Associate

**Juliette Griffith**  
Billing Associate

**Caroline Hannon**  
Senior Billing Associate

**Edmund Kelly, CMBS**  
Supervisor, Chart Acquisition

**Holly Kirkpatrick**  
Senior Billing Associate

**Michael Kurey**  
AR Data & Payer Relations Manager

**Sabrina Linscott**  
Senior Billing Associate

**Cathy Manzelli**  
Supervisor, Payment Posting

**Sonja Moon, CPC, CPMA**  
Senior Coder

**Laurie Muniz**  
Senior Billing Associate

**Darrin Thomas**  
Billing Associate

**Ingrid Olivo**  
Billing Associate

**Lee Ann Otolo**  
Senior Billing Associate

**Caitlin Parece**  
Supervisor, Accounts Receivable

**Samantha Payne, CPC**  
Senior Coder

**Carmen Saralegui, RHIT, CPC, CGSC**  
Coding & Compliance Manager

**Eileen Starr**  
Billing Associate

**Trinia Thompson, CPC**  
Senior Coder

**Marissa Tierney, CCA**  
Team Lead, Coding

**Patricia Varitimos, CPC, CANPC**  
Manager of Revenue Cycle

**Kim Weinstein**  
Senior Billing Associate

**Judith Wells, CPC**  
Senior Coder

**Ruth Zung**  
Senior Billing Associate

**Allyson Silva, CPC**  
Coding Analyst

**Paulette Simmons CCS, CPC, COC, CRC**  
Senior Coder

**Virginia Wells, BSHA, CPC**  
Senior Coder

**Susan McClain, CPC**  
Senior Billing Associate

## Administrative Team

### Department Administration

**Dawn Ferrazza, MA**  
Chief Administrative Officer

**Brian Duckman, MBA/MHA**  
Director, Anesthesia, Critical Care and Pain Medicine

**Mike Broglio**  
Sr. IT Project Manager

**Stephanie Pariser**  
Sr. Business/Operations Analyst

**Min Jeon**  
Anesthesia Program Administrator

### Communications

**Heather Derocher, MA**  
Director, Communications and Special Projects

**Beth Hill**  
Project Administrator, Communications

**Ann Plasso**  
Communications Specialist

### Finance

**Trish Stevens, MBA**  
Director, Finance

**Ahmet Akcay, MS**  
Financial Administrator

**Richard Lynch**  
Senior Budget Analyst

**Jackie Thompson**  
Senior Accounts Payable Specialist

### Revenue Cycle

*(See page 216 for Anesthesia Financial Solutions, LCC team list)*

**Shannon Cameron, MBA, MHIIM, CPC**  
Executive Director of Revenue Cycle

### Clinical Support

**Gidget Hunter**  
Administrative Coordinator, East Campus

**Michelle Marshall**  
Administrative Coordinator, Critical Care

**Jackie Villafuerte**  
Administrative Coordinator, West Campus

### Community

**Krystyna Prokopiuk**  
Executive Director, APHMFP

**Nikki Murphy**  
Project Manager, APHMFP

**Danielle Schepis**  
Outpatient Authorization Pain Specialist, APHMFP

### Scheduling

**Joanne Grzybowski, MBA**  
Manager, Scheduling Operations, HMFP/APHMFP

**Christine Kuhn**  
Schedule Administrator, HMFP

**Lisa McGuirk**  
Scheduling Administrator, APHMFP

**Katarzyna (Kate) Lada**  
Scheduling Administrator, APHMFP

**Anesthesia Technical**  
*(See page 215 for team list)*

**Ed Plant, CE**  
Technical Director

**Tom Malboeuf, Cer.AT**  
Clinical Manager

**Arnold – Warfield Pain Management Center**  
*(See page 216 for team list)*

**Juanita Brown**  
Practice Manager

**Vittaya Jaraskul**  
Rev Cycle Supervisor

**Elizabeth Carvelli, RN, DNP**  
Nursing Director

**Melissa Egan**  
Practice Coordinator

### Education

**Mary Jane Cahill, MBA, C-TAGME**  
Manager, Medical Education Programs

**Kimberley Brown**  
Fellowship Program Coordinator

**Michael Chen**  
Anesthesia Education Lab Assistant

**Roxanne Erikson**  
Residency/Fellowship Program Coordinator

**Ron Mayes**  
Program Administrator, Continuing Medical Education

**Alexandra Toussaint**  
Residency/Fellowship Program Coordinator

**Vanessa Wong**  
Project/Grant Coordinator, Education

### Professional Affairs

**Susan Herlihy Kilbride, BSN**  
Director of Professional Affairs and Recruitment

**Nora McCarthy**  
Project Administrator, Professional Affairs and Recruitment

**Letisha Phillips**  
Project Administrator, Credentialing, Privileging and Enrollment

**Taneshia Pina**  
Program Administrator, Professional Affairs

**Yvette Dusabe**  
Administrative Coordinator, Professional Affairs and Recruitment

**Diane Baranowski**  
Project Administrator, Credentialing, Privileging and Enrollment

**Rosanna Kelleher**  
Professional Affairs, Physician and Certified Nurse Anesthetist Recruiter

### Quality, Safety, Innovation and Information Technology

**Sarah Nabel, MS**  
Director, Quality, Safety, Innovation and Informatics Associate in Anaesthesia at HMS

**Matt Bornstein, MS, CPHIMS, SHIMSS**  
Manager of Anesthesia Systems and Data Management

**Tom Xie, MS**  
IT Operations Manager

**Reshma Abraham, MPH**  
Safety Project Management

**Bob Carlin**  
Operations Project Management

**Jo Ann Jordan, MS**  
Senior Data Project Manager

**Praveena Muthuraj, MS**  
Application Architect

**Rob Ruiz**  
Technical Analyst

**Tuyet Tran, MS**  
Data Analyst

**Laura Ritter-Cox, MSN, RN-BC**  
Nurse Informatics Specialist

**Jobe Diagne**  
Systems Technical Analyst I

**Nick Latta**  
Application Analyst

### Research

**Alexander Shtifman, PhD**  
Director, Anesthesia Research

**Valerie Banner-Goodspeed, MPH**  
Program Manager, Anesthesia Research



# Thank you to our entire Department for your compassion, care and excellence over the past two years

## Our chair reflects on the challenges and rewards of leading through the crisis

COVID-19 has been ongoing at one level or another for the past year and a half, and the loss of life has been heartbreaking. I am reminded of the opening words of Charles Dicken's novel, "A Tale of Two Cities" - "It was the best of times; it was the worst of times" - while it has been enormously challenging and difficult, we rose up together as a department and faced the challenge with skill, compassion, and determination. Never have we been more valued and appreciated.

**"Our department emerged from COVID stronger than ever,"**  
—Dr. Daniel Talmor

Even in these dire circumstances, our department was ahead of the game and not reactive. We asked staff to mask and glove before the first case was identified in

Massachusetts. We ran dozens of simulations and trainings on how to treat COVID patients in the OR and modified these over time based on experience. This ensured that *no one's first COVID patient was an actual patient but a mannequin*. This effort was led by our quality and safety division and allowed us to be ready for patients.

Our usual ICU capacity here at BIDMC is 77, but in May of 2020 we peaked at over 100 COVID patients in the ICU, almost all of them ventilated. At one point we were caring for 130 patients in our ICUs. How did we do this? Our teams of attendings, residents and CRNAs worked around the clock to turn PACUs and medical floors into ICUs for the surge of sick patients. We didn't need to ask anyone to help - everyone volunteered to step up and do the work and then to step up again and care for the patients in these units. This happened at our community hospitals as well. Our teams led the ICUs in Milton and Plymouth and this was critical in our ability to maintain appropriate patients in the community, leaving the sickest to come here to BIDMC.

Anesthesiologists from our department established and manned the acute care team at Boston Hope, the Massachusetts Field Hospital at the Boston Convention Center, where patients were cared for who needed oversight but didn't need to be in a traditional hospital. This effort opened up space in the hospitals for the huge influx of very sick patients who needed around the clock care. This kind of performance by our teams shows that an anesthesia department brings value not only in the operating room but through everything it does.

The COVID pandemic embodied the social mission of our department to care for the neediest patients. Due to our community outreach and the nature of the disease (patients of color were afflicted disproportionately by the virus), we cared for huge numbers of underserved patients across our hospitals. This reflected the BILH philosophy that *healthcare is a human right*. Through our relationships with Cambridge Health Alliance, Brockton and Lawrence General Hospital, we transferred to BIDMC dozens of critically ill patients from some of the poorest communities in Massachusetts and delivered outstanding care. And the proof is in the outcomes. We cared for the most richly diverse patients in the state and despite the obstacles our mortality index was lower than expected.

As I write this, we are facing a third wave of COVID and after a quiet early summer, cases are starting to rise again. I can't predict exactly what will happen with COVID, but one thing I can say with absolute conviction is that our department is prepared and ready to care for our patients. I salute and thank each and every one of you who took part in fighting COVID these last 18 months and am proud to lead this remarkable department.

—Danny





Beth Israel Deaconess  
Medical Center



HARVARD MEDICAL SCHOOL  
TEACHING HOSPITAL

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