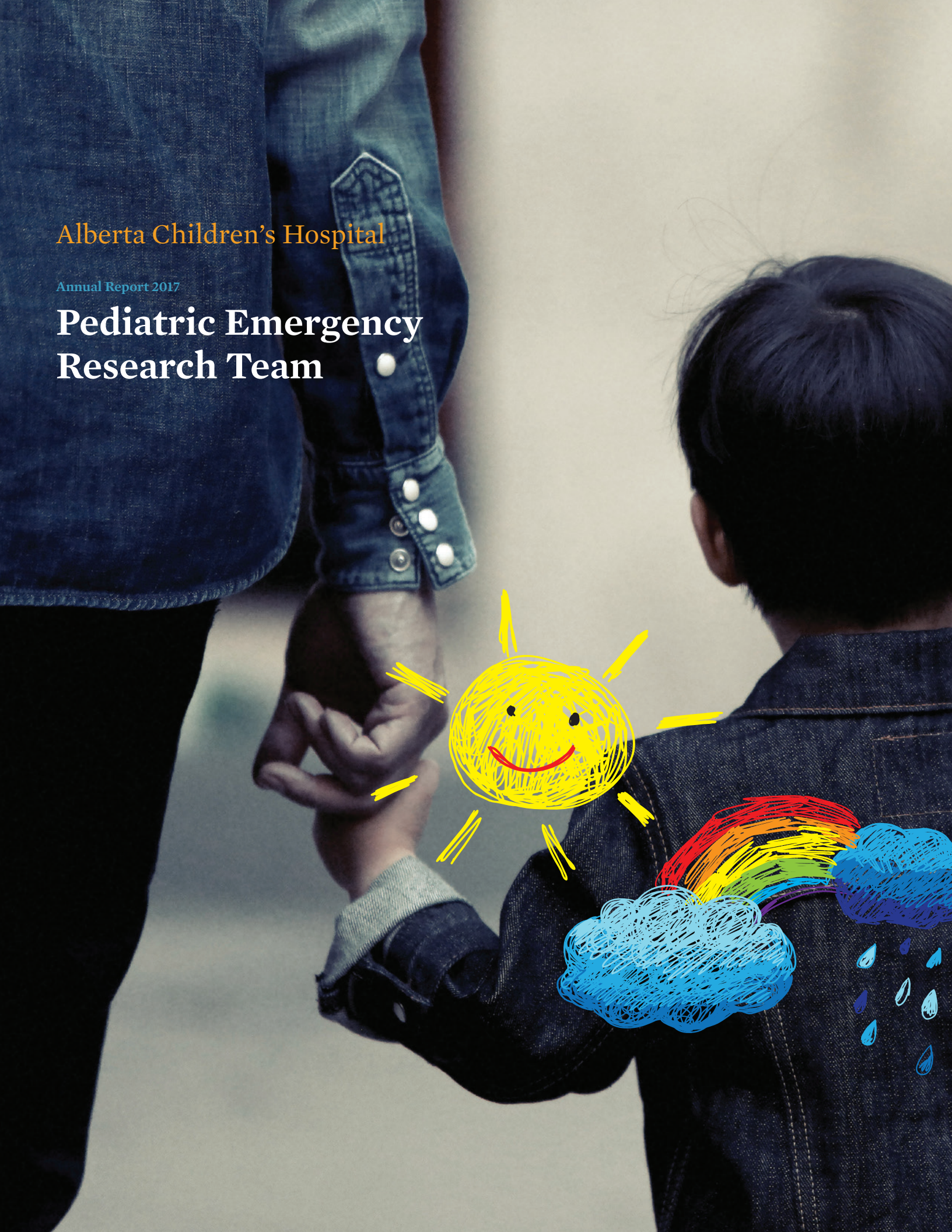


Alberta Children's Hospital

Annual Report 2017

Pediatric Emergency Research Team



Mission/Vision

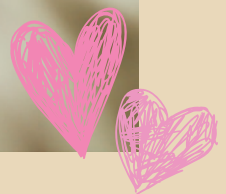
Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

Mission:

To improve outcomes for acutely ill and injured children by creating and sharing new knowledge.

Vision:

Exceptional acute care for children through innovation and discovery.



Background



Summary

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

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Over the past 12 months the emergency department (ED) at the Alberta Children's Hospital (ACH) cared for over **85,000** ill and injured children. Children are cared for 24 hours a day, seven days a week. The high volume and diversity of patients seen in the ED provides a unique opportunity for generating new knowledge and improving the quality of pediatric care. Our research team is one of the largest pediatric emergency research teams in Canada. In the past year we generated new knowledge with the potential to improve outcomes for patients with diarrheal illnesses, severe infections, trauma, abdominal pain, respiratory emergencies and painful injuries. Our team members contributed to the science of resuscitation, precision medicine, quality improvement and simulation. In the past year we had **52** peer reviewed publications and received substantial funding from local, national and international sources.

Year in Review: July 1, 2016 – June 30, 2017

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

Clinical:

EXCEPTIONAL CARE
FOR OVER

85,000

CHILDREN

PROVIDED BY A TEAM OF

62 physicians

AND OVER

200 nurses

Research:

THE RESEARCH TEAM
ENROLLED OVER

1200 patients

AND GENERATED

52 publications

WITH GRANT FUNDING TALLING

\$5,706,107

Principle investigator (PI)/co-PI

\$8,976,014

Co-investigator/collaborator

Education:

APPROXIMATELY

275 medical trainees

INCLUDING MEDICAL STUDENTS, RESIDENTS
AND FELLOWS, WERE TRAINED IN THE ACH ED.

PERT: Pediatric Emergency Research Team

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

Who we are

Physicians:

Angelo Mikrogianakis

Section Lead

Antonia Stang

Research Lead

Graham Thompson

Medical Director PEMRAP

David Johnson

Senior Medical Director, Alberta Health Services Maternal Newborn Child & Youth Strategic Clinical Network (MNCY SCN)

Stephen Freedman

Alberta Children's Hospital Foundation Professor, Child Health and Wellness, ACHRI, Healthy Outcomes, Theme Lead

Jennifer Thull-Freedman

Quality and Safety Lead

Adam Cheng

Simulation Research Lead

Kelly Millar

Education Lead

Vincent Grant

Simulation Medical Director

50+ Emergency Department Physicians

Research Nurses:

Clare Howland

Nikki Wilson

Jen Crotts

(PEMRAP Lead)

Erin LaLande

Elisabeth Schuetzle

200+ Emergency Department nurses

Coordinators/Research Assistants:

Karen Lowerison

Jianling Xie

Sarah Williamson-Urquhart

Kelly Kim

Fady Dawoud

Tatum Mitra

Becky Emerton

Administration:

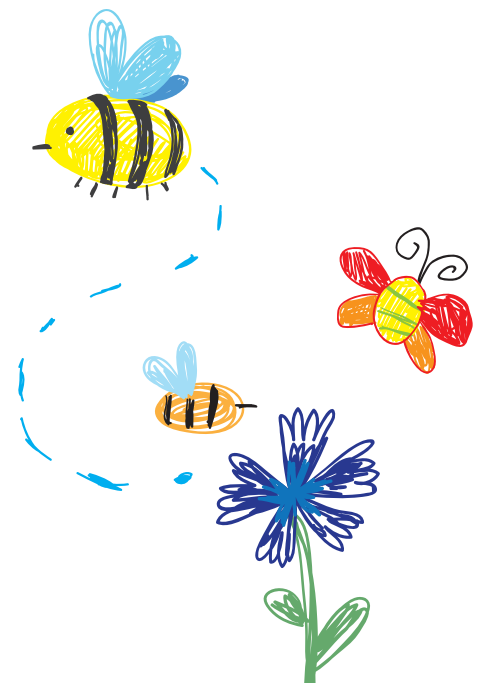
Trish Robinson

Gail Wright-Wilson

Brandy Schreyer

Julie Slinn

50+ Volunteer Research Assistants
(Pediatric Emergency Medicine Research Assistant Program PEMRAP)



Highlights

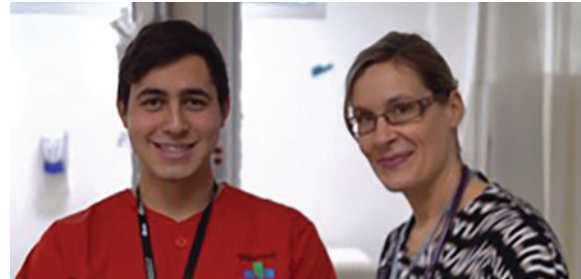


PEMRAP

Pediatric Emergency Medicine Research Assistant Program

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

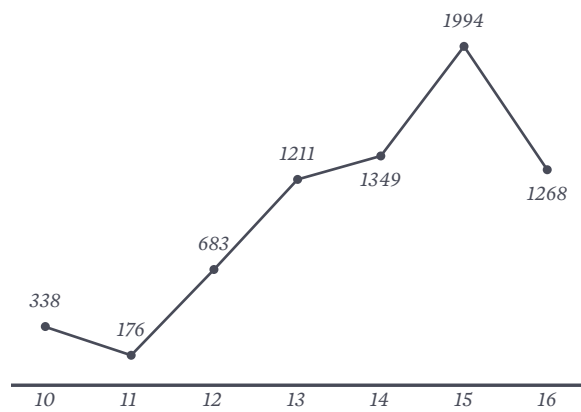
More than 300 undergraduate students have participated in Pediatric Emergency Medicine Research Assistant Program (PEMRAP)



Students can take on different roles as they progress with PEMRAP. Command Students provide mentorship and training to new students entering the program and Student Coordinators provide leadership and help shape the direction of the PEMRAP program.

PEMRAP was established in the fall of 2010 by Dr. David Johnson and Janie Williamson. At the time of PEMRAP's inception the Pediatric Emergency Research Team was small but growing and there was a clear need to develop innovative, efficient, and cost effective means of maximizing the recruitment of potential study participants in the ED. The PEMRAP program prides itself on being an exceptional environment for students to gain exposure to high quality, high impact clinical research projects that ultimately will shape the future of health care. Many PEMRAP members progress to pursue medicine or other health related careers.

Research team enrollments per year



PEMRAP

Pediatric Emergency Medicine Research Assistant Program

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

“PEMRAP was my first in-depth look into research and introduced me to the fast-paced environment of the Emergency Department (ED). PEMRAP was a key determinant in my decision to pursue a masters degree and has helped me develop skills that will hopefully aid in my career goal of being a clinician-scientist.”

Tatum Mitra, PEMRAP Student Coordinator (and PEMRAP volunteer for 5+ years!)

“Helping our volunteers see the value in high quality research, as well as helping increase their comfort in working closely with patients and families in a dynamic care environment, draws on my strengths as a Registered Nurse. By far, one of the greatest sources of satisfaction in my job comes from working with our PEMRAP volunteers.”

Clare Howland, PERT RN

“Fingerprinting” in the Emergency Department — Precision Medicine and Bio-profiling

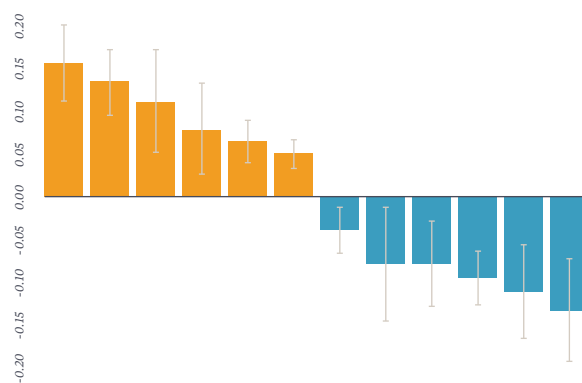
A new generation of diagnostic testing is emerging: precision medicine bio-profiling. Using advanced methods such as mass-spectrometry (metabolomics, metallomics) and sequencing technologies (genomics, transcriptomics), precision medicine bio-profiling integrates multiple points of data to provide a precise “signature” identifying a specific illness, similar to how our fingerprints identify each of us as individuals. Bio-profiles help us understand how the body is reacting to an illness (i.e. which genes are being turned on and off, known as transcriptomics). They can also be used as tools to improve diagnosis.

Abdominal Pain is one of the most common reasons a child will visit the Emergency Department, and parents/caregivers are often concerned about the possibility of appendicitis. PERT investigators are studying ways to improve the diagnosis of appendicitis through precision medicine bio-profiling. To date, over 350 children have been enrolled in our appendicitis bio-profile studies. Our recent studies have shown excellent results in determining which metabolites go up (green) versus down (black) in children with appendicitis. This has led us to develop bio-profiles that can be used to separate those children with appendicitis from those with other causes of abdominal pain. These profiles can also help determine how severe the illness is (simple versus perforated). Our goal is to use this information to develop a rapid bed-side test that can be used to diagnose appendicitis, leading to improved patient outcomes and experiences in the Emergency Department.

08

Precision medicine bio-profiling integrates multiple points of data to provide a precise “signature” identifying a specific illness, similar to how our fingerprints identify each of us as individuals.

Significant serum metabolics and inflammatory mediators



Commitment to Comfort

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

The Commitment to Comfort team received the 2017 Patient Experience Award from the Health Quality Council of Alberta. This team includes several members from the Section of Emergency Medicine: **Jennifer Thull-Freedman (team lead)**, **Antonia Stang**, **Shirmee Doshi**, **Michelle McTimoney**, and **Erik Saude**. Additional members at ACH include nursing leads **Erin Pols** and **Ashley McFetridge**, and Project Manager **Suzanne Libbey**.

The Commitment to Comfort Initiative was developed at the Alberta Children's Hospital (ACH) emergency department (ED) to engage families as partners in improving pain outcomes for children.

The Commitment to Comfort team worked with families and patients to create and provide tools, such as posters and Comfort Menus, to help families advocate for their comfort needs. It also ensures staff have the proper tools to meet these needs, such as pain scales and comfort kits, and that they are knowledgeable on how children understand and remember pain, so they can use appropriate language when talking to children and provide helpful support during procedures. The research team played a key role in the project by collecting information from over 900 patients and families on their pain experience at the ACH ED. After success at the ACH, the Commitment to Comfort program was spread to all Calgary emergency departments where children are treated. Currently, 40 rural, regional, and urban emergency departments in Alberta, representing all zones, have agreed to participate in the provincial phase of the Commitment to Comfort initiative.

Currently, 40 rural, regional, and urban emergency departments in Alberta, representing all zones, have agreed to participate in the provincial phase of the Commitment to Comfort initiative.



Gastrointestinal Emergencies

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

Changing the Management of Diarrheal Diseases

The Alberta Provincial Pediatric EnTeric Infection TEam (APPETITE), led by Dr. Stephen Freedman is rapidly altering the approaches to and management of diarrhea in children. The team has shown that collecting stool specimens at home can be replaced by performing rectal swabs at the point of care thereby expediting diagnoses, minimizing inconvenience and biohazard risks to caregivers. The team is actively working with Calgary Laboratory Services and ProvLab Alberta to integrate this new knowledge into clinical care.

The APPETITE team has also produced impactful knowledge and documents that standardize and improve the care of children with a potentially deadly cause of diarrheal disease — Shiga Toxin-producing *E. coli* (STEC). They have shown that antibiotic use must be avoided in infected children as it increases the risk of developing a complicated and severe clinical course called Hemolytic Uremic Syndrome (HUS). They have also identified that children with HUS who are dehydrated are at increased risk of complications (kidney, brain) and death. This has led to broader recognition of the importance of early diagnosis, close biochemical monitoring, and ensuring that hydration is maintained. These principles of therapy are now being shared across the province of Alberta, as well as other regions of North America.

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Gastrointestinal Emergencies

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

Identifying Infectious Causes of Vomiting and Diarrhea in Children

Through the implementation of advanced diagnostic technology, the APPETITE team has worked to dramatically enhance the ability to identify infectious etiologies in children with vomiting and diarrhea. Traditional testing is limited to evaluation diarrheal stool specimens, children with vomiting in the absence of diarrhea cannot be tested. Traditional testing platforms can only identify a cause in 25-30% of children with diarrhea. The APPETITE team's expanded diagnostic platform has expanded testing to include children who have isolated vomiting. When employed on over 7500 specimens from children with vomiting or diarrhea from across the province, a potential pathogen is identified in over 70% of children.

Identifying Infectious Causes of Vomiting and Diarrhea in Children

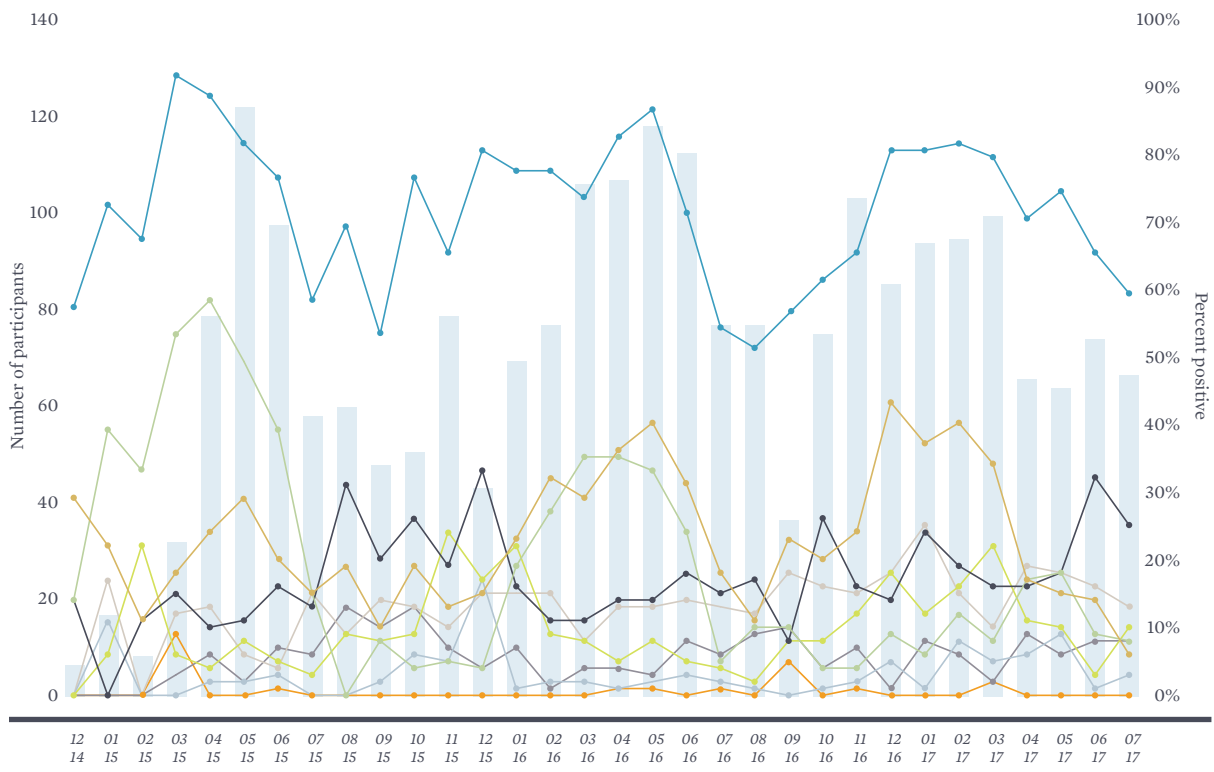


Figure 1: The light blue bar in the graph represents the number of enrolled patients with at least one test performed by month (against left vertical axis). The blue line represents the % patient with at least one positive result for the targets. The % positive of each of the viral targets, *C. difficile*, enteric bacteria as a group, and parasites as a group are also presented above (against right vertical axis).

*The group of bacteria includes *Campylobacter* spp, *E.coli* O157, ETEC, *Salmonella* spp, STEC, *Shigella* spp, *Vibrio cholera*, *Yersinia enterocolitica* and *Aeromonas* spp. †The group of parasites includes *Cryptosporidium*, *Entamoeba histolytica* and *Giardia*. The % patient with more than one target tested positive is not shown.

Resuscitation

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

Cardiopulmonary resuscitation (CPR) is the most important treatment for pediatric cardiac arrest (PCA). The research team at Alberta Children's Hospital is using simulation-based methods to conduct research aimed at improving survival from paediatric cardiac arrest. This includes projects designed to determine the best method of training, projects exploring human factors issues during resuscitation, and others research incorporating new technology aimed at improving CPR quality. Specifically our team has recently completed the following studies

1. We assessed the impact of distributed CPR training, with a just-in-time CPR training unit available for use in the ED. The program integrates distributed just-in-time training with real-time quantitative feedback to improve the quality of CPR. The CPR quality of providers receiving interventions were significantly superior to the providers receiving conventional training.
2. Cardiopulmonary resuscitation (CPR) performed on a mattress decreases effective chest compression depth. In this study, we tried to determine the effect of a CPR board, a slider transfer board, a CPR board with a slider transfer board, and a flat spine board on chest compression depth with a mannequin placed on an emergency department mattress. We found that the use of spine board alone or the combination of a CPR board and slider transfer result in least mattress compressibility.
3. Who is the best cardiopulmonary resuscitation (CPR) provider during resuscitation? Is there a value of using stepstool when providing CPR? We found that the use of step stool was associated with improved compression depth and that there is an association between provider height and compression depth.



The research team at Alberta Children's Hospital is using simulation-based methods to conduct research aimed at improving survival from paediatric cardiac arrest.

Partnerships/Collaboration

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

The Pediatric Emergency Research Team (PERT) supports the work of collaborators from across the hospital, the University of Calgary, and the entire country. A sampling of current studies include: the use of nebulized magnesium sulphate in children with asthma hoping to enhancing the likelihood that children will improve and be able to go home with their parents, the use of magnetic resonance imaging (MRI) in children who have abdominal pain to determine if they have appendicitis, and the collection of data on children with abdominal trauma to identify the best approaches to care. A few core collaborations that extend beyond individual studies include our ongoing work related to concussion, precision medicine and the microbiome.

- 1) **Concussion:** The PERT team has recruited children to participate in a multitude of concussion studies being led by collaborators including Drs. Karen Barlow, Roger Zemek, Brian Brooks, and Keith Yeates. Through this work we have derived a clinical risk score to predict persistent post-concussion symptoms, evaluated the use of melatonin in children with post-concussion syndrome, and the feasibility of performing computerized cognitive testing in the pediatric ED after a concussion which may help clinicians predict which youth will remain symptomatic at follow-up.

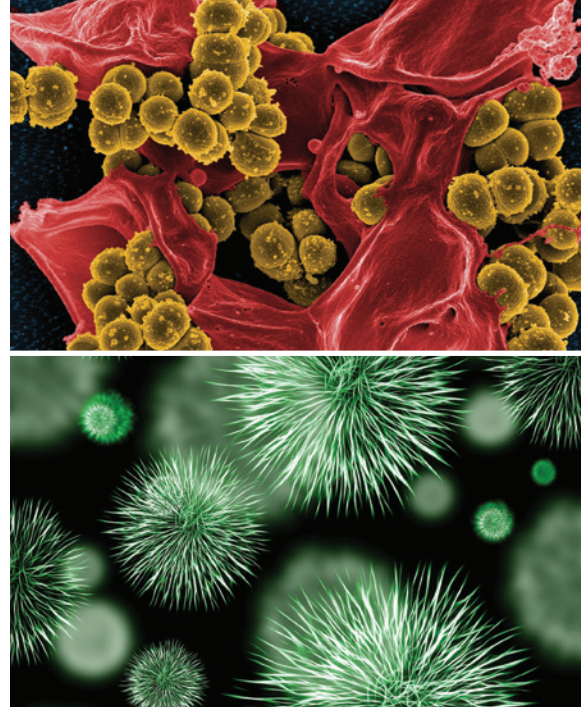


A few core collaborations that extend beyond individual studies include our ongoing work related to concussion, precision medicine and the microbiome.

Partnerships/Collaboration

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

- 2) **Precision Medicine:** PERT investigators are leaders in bringing Precision Medicine to the ED setting. Our collaborations with bench-side researchers at the University of Calgary have led to exciting discoveries in children with sepsis (overwhelming infection). Our recent studies with the Alberta Sepsis Network have revealed bio-profiles that could help health care providers in determining which children visiting the ED with infections are likely to have severe disease needing Intensive Care (PICU) compared to those that could be safely cared for outside a PICU.
- 3) **Microbiome:** We are collaborating with Drs. Marie-Claire Arrieta and Kathy McCoy to understand the impact that early life antibiotic exposure has on the microbiome of neonates and infants. Specifically, we are focused on identifying alterations in the fungal organisms present in the intestines of young infants treated with antibiotics for urinary tract infections. We believe that alterations may be occurring in these infants that will predispose them to the development of asthma later in life. We are working together in the hope to transform this research idea into a potential therapeutic means to prevent such alterations from occurring.



Reporting



Publications: July 1, 2016 – June 30, 2017

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

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3. Bhanji F, Praetgaard A, Meaney P, **Cheng A**, Peberdy MA, Hunt EA, Berg R, Nadkarni V. Survival from Pediatric In-Hospital Cardiac Arrest is worse at Night Compared with Days and Evenings: A Report from the AHA Get with the Guidelines-Resuscitation (GWTG-R) Registry. *JAMA Pediatrics*. 2017; 171(1): 39-45.
4. Brooks BL, Low TA, Daya H, Khan S, **Mikrogiannakis A**, Barlow KM. Test or Rest? Computerized Cognitive Testing in the Emergency Department after Pediatric Mild Traumatic Brain Injury Does Not Delay Symptom Recovery. *J Neurotrauma*. 2016 Dec 1;33(23):2091-2096. Epub May 9.
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6. **Cheng A**, **Grant V**, Huffman J, **Burgess G**, Szyld D, Eppich W. Coaching the Debriefers: Peer Coaching to Improve Debriefing Quality in Simulation Programs. *Simulation in Healthcare*. Published online May 20, 2017.
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9. **Cheng A**, Kessler D, MacKinnon R, Chang T, Nadkarni V, Hunt EA, Duval-Arnould J, Lin Y, Cook DA, Pusic M, Hui J, Moher D, Auerbach M for the INSPIRE Network Reporting Guidelines Working Group. Reporting Guidelines for Health Care Simulation Research: Extensions for the CONSORT and STROBE Statements. *Advances in Simulation*. July 25 2016; 1:25.
10. **Cheng A**, Kessler D, MacKinnon R, Chang T, Nadkarni V, Hunt EA, Duval-Arnould J, Lin Y, Cook DA, Pusic M, Hui J, Moher D, Auerbach M for the INSPIRE Network Reporting Guidelines Working Group. Reporting Guidelines for Health Care Simulation Research: Extensions for the CONSORT and STROBE Statements. *Simulation in Healthcare*. Aug 31 2016; 11(4):238-248.
11. **Cheng A**, Kessler D, MacKinnon R, Chang T, Nadkarni V, Hunt EA, Duval-Arnould J, Lin Y, Cook DA, Pusic M, Hui J, Moher D, Auerbach M for the INSPIRE Network Reporting Guidelines Working Group. Reporting Guidelines for Health Care Simulation Research: Extensions for the CONSORT and STROBE Statements. *BMJ STEL*. Sept 30 2016; 2:51-60.
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Publications

Alberta Children's Hospital Pediatric Emergency Research Team (PERT) | Annual Report 2017

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17. Donoghue A, Lin Y, Duff J, **Cheng A.** Application of Simulation-based Research for Pediatric Emergency Medicine. *Clinical Pediatric Emergency Medicine*. 2016; 17(3):231-237.
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23. **Freedman SB**, **Johnson D**, Nettel-Aguirre A, **Mikrogianakis A**, **Williamson-Urquhart S**, Monfries N, **Cheng A.** Assessing Dehydration Employing End-Tidal Carbon Dioxide in Children with Vomiting and Diarrhea. *Pediatric Emergency Care*, 2017 May 23. [Epub ahead of print].
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Publications

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Thank you!



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