RESEARCH @CHEOhospital makes an impact

2015 ANNUAL REPORT

uOttawa

Contents

Vision

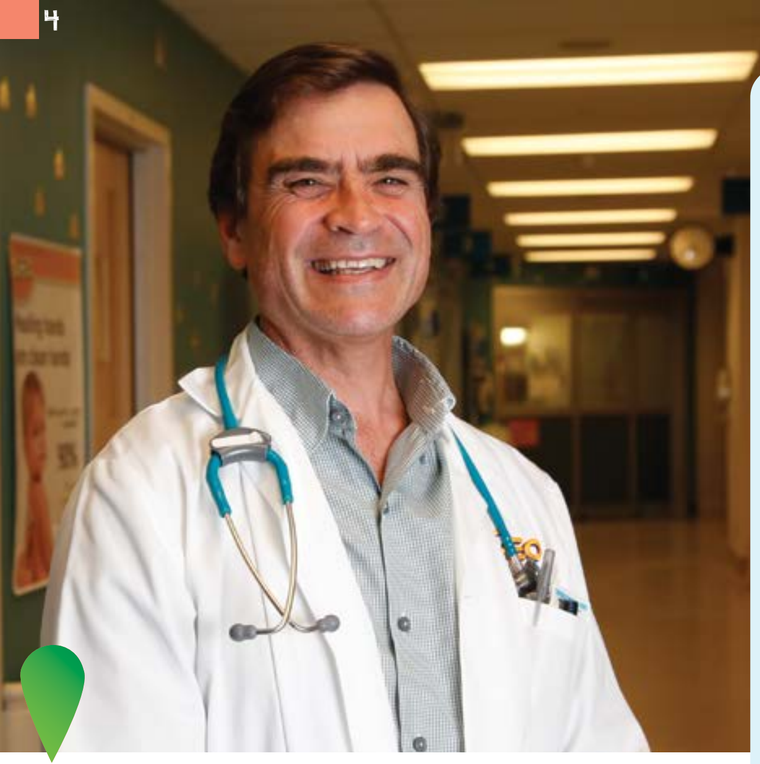
Discoveries today for healthier kids tomorrow.

Values

Excellence | Passion | Integrity | Creativity | Collaboration

Mission

We conduct innovative research in a dynamic learning environment and translate that knowledge into practice and policies to improve the health of children, youth and their families.



On behalf of everyone who conducts or supports research at CHEO, we are so grateful that you all stand behind our efforts to make *Discoveries Today for Healthier Kids Tomorrow*.

CHEO research takes many forms. It can be a patient chart review or survey; lab analysis of cells or tissue cultures; or bringing novel therapies and treatments to the patient's bedside. One common thread weaves through everything we do; it's everyone's goal to conduct research to create better outcomes for children, youth and their families.

Research at CHEO makes an impact – on our understanding of pediatric diseases, on the lives of patients and their families, and for a healthier society at large. Research at CHEO has no borders, which means we collaborate with scientists locally, nationally and internationally and share our results widely so that anyone can apply discoveries made here.

We have three dedicated research buildings on site, but the reality is that research occurs everywhere: on the hospital wards, in the emergency department, in the OR's and in the many clinics, labs, and offices throughout CHEO. Our staff, trainees, clinical investigators, and scientists have the full support CHEO leadership behind them as well as state-of-the-art equipped labs to enable our researchers to compete for funding at the highest level.

We are also a tertiary care, academic learning centre, so in collaboration with University of Ottawa Faculties (including Medicine, Health Sciences and Social Sciences), we place a strong emphasis on mentoring the next generation of researchers. You will notice that we have highlighted some of our trainees in this report. They are the life-blood of the institute and keep us all young at heart!

Also featured in this 2015 Annual Report are success stories, discoveries, and people who are at various stages of their research career. Again, all have made an impact in their field of expertise with a focus on improving outcomes for patients.

I think it is important to note that research is a "team sport". Although we've quoted the lead investigators, there is a team of research coordinators, assistants, lab managers, contract negotiators and so on, that contribute to all research projects at CHEO. Every lead investigator is the first to talk with great pride about their hardworking, dedicated, enthusiastic teams.

I want to thank our local community for its support of research at CHEO and our colleagues at the CHEO Foundation who work tirelessly to promote the impact of our work. I also thank the thousands of children, youth and parents who have participated in research studies this past year. On behalf of everyone who conducts or supports research at CHEO, we are so grateful that you all stand behind our efforts to make Discoveries Today for Healthier Kids Tomorrow.

Looking forward to yet another impactful year ahead,

Dr. Martin Osmond

CHEO Research IMPACT 2018

Our current strategic plan is a 3-year plan notably called Impact 2018. It consists of four strategic directions that see us integrating research into clinical care; developing sustainable funding models; building research capacity; and translating discoveries to the bed-side focusing on areas of strength and new methodologies.

With these strategic directions, research at CHEO will ***make an impact*** – on our understanding of pediatric disease; on the lives of patients and their families; and for a healthier society at large. Following is a snapshot of our continuous improvements as part of this plan.

Strategic Direction No. 1
Integrate research throughout CHEO

Research at CHEO is:

- Incorporated into the messaging provided at CHEO Corporate Orientation; providing all new staff with current information about CHEO research impact and metrics
- Visible on posters throughout the patient wards, for the first time
- Communicated broadly but also in-depth at the departmental-level; we launched a pilot communications campaign in the Emergency Department
- Supported by a dedicated Research Coordinator at the in-patient level
- Measured year over year by the number of patients and families engaged; in 2015 over 36,000 people participated in research at CHEO!

Strategic Direction No. 2
Engage patients and families

Our leadership team has:

- Joined a provincial task force on patient engagement at the Ontario SPOR (strategy for patient-oriented research) Support Unit
- Integrated research updates into MyChart, an electronic healthcare reporting system that is accessible by patients and families
- Ensured that research FAQs and Current Research projects are clearly communicated on our website **(www.cheori.org)**
- Initiated a 'research patient engagement steering committee' to create a strategy and terms of reference for engaging patients and families in research at CHEO

Strategic Direction No. 3
Translate discoveries to patient care

Our leadership team has:

- Initiated a formal review of how we conduct delegated Research Ethics Board reviews, to shorten wait times and improve processes
- Hired dedicated staff to bolster our capacity to conduct large scale systematic reviews
- Formalized three bed-to-bedside 'think tanks' to encourage collaboration and knowledge-sharing within genetics, oncology and big data research programs at CHEO
- Expanded our contracts office to improve wait times
- Implemented mandatory monitoring of all clinical studies involving regulated trials, prior to submitting to Health Canada
- Created a memorandum of understanding in partnership with The Ottawa Hospital to harmonize the application for Ethics approval in the instance of shared projects

Strategic Direction No. 4
Secure novel funding

Our leadership team has:

- Significantly increased federal funding for summer studentships
- Created a new position of Research Funding Development Officer dedicated to the pursuit of novel funds
- Created and hosted the first donor event dedicated to funding research at CHEO
- Partnered with the CHEO Foundation to introduce new internal award opportunities: research growth awards, studentship awards, and capacity building awards

#allergies

Your child is wheezing; she can't breathe. A rash is forming over her body and she is turning blue. She is dizzy. All of a sudden, she vomits. She is having a severe allergic reaction, or anaphylaxis.

A half-eaten granola bar is clutched in her fist and you spot the phrase "may contain peanuts" on the wrapper. Panic sets in and you are frozen. Your heart is pounding and you are desperately trying to remember the steps the doctor told you to follow in this situation.

Once CHEO's Anaphylaxis Action Plan is released, parents and caregivers will breathe a sigh of relief not having to go through these terrifying moments. They will know exactly what to do.

CHEO Emergency Department physician, Dr. Waleed Alqurashi, and his research team recognized that there are times parents don't identify the signs of anaphylaxis. They can be confused and scared about what to do when a severe allergic reaction occurs. This led to the creation of a colorful, easy-to-read, and child-friendly guide. Designed with validated pictograms, it allows the information to be conveyed visually and enables the reader to take the right steps, right away.

"In addition to taking the appropriate measures to prevent acute allergic reactions, the plan focuses on making patients and their families' comfortable dealing with them. They shouldn't be avoiding activities because of concern about anaphylaxis," said Dr. Alqurashi when asked about the fear parents have sending children with allergies on playdates or out in public. "If you have the tools and the understanding of how to recognize it and treat it - then there should be no reason for anaphylaxis to control your or your family's life. That's really the hope, to impact the quality of life for people."

Published as Editor's Choice in the respected academic journal *Pediatric Allergy and Immunology*, this was just the beginning of Dr. Alqurashi's contributions to anaphylaxis research in 2015.

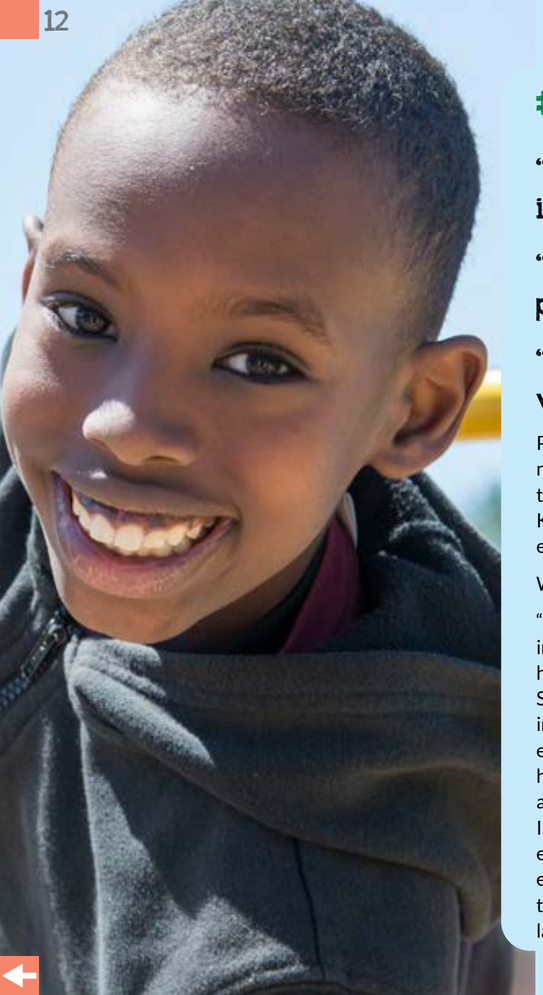
In the first-ever pediatric study of the predictors of biphasic anaphylactic reactions, he and his team were able to identify the triggers of a repeat, delayed anaphylactic reaction. These delayed reactions were occurring hours, sometimes days after the initial symptoms of the allergy went away—even if the substance that caused the original reaction was not present. They found that if the initial reaction was severe or not treated with epinephrine, or if the administration of epinephrine was delayed, the likelihood of a biphasic anaphylaxis reaction would increase—and would be more severe.

In addition, Dr. Alqurashi and his team were also able to create an evidence-based prognostic tool for physicians to identify and monitor the serious anaphylaxis cases more effectively. Not only does this make better use of hospital resources, but the children with milder reactions who do not match the predictors of more serious biphasic reactions, are able to go home faster as well.

Noted as one of the top three anaphylaxis papers published in the esteemed journal *Annals of Allergy, Asthma & Immunology*, this study wraps up a hallmark year for Dr. Alqurashi.

"Research is about making an impact. It's why we do what we do, every single day. That's what I care most about: impact in patient care and impact in clinical care. Anaphylaxis is quintessential of emergency medicine. This area of study is relatively new, yet it's a serious struggle for parents to deal with. Anybody who has either a family member or friend with anaphylaxis, especially children, understands this very well. That's where I hope the action plan impact is going to be - improving patient care. For the predictor study, the measurable impact for clinicians is to better manage children with anaphylaxis, which is what I'm quite happy with."

CHEO and parents of children with allergies are grateful to this caring doctor and his contributions to the field of anaphylaxis. As for Dr. Alqurashi, he sums up his 2015 success story thoughtfully, "I strongly believe that the secret ingredient to the success of our work is the public. We are truly lucky to have such a community of curious, engaged, and intelligent people who also want to make an impact."



#physicalactivity

"If you go to hockey practice, I will take you for ice cream after."

"But Chris and Mason love soccer, don't you want to play like them?"

"If you don't go to tryouts today, then you can't play video games tonight."

Parents, do you hear yourselves in these statements? Even though we intuitively know it's not good to force or bribe children to engage in physical activity, these reward/punishment type pressures do tend to work in the short term. Based on the evidence, however, Dr. Katie Gunnell at CHEO can confirm that it actually undermines the results we want — especially in the long run (pardon the pun).

Well parents, it's time for a paradigm shift.

"Measuring Perceived Barriers to Physical Activity in Adolescents" was published by Dr. Gunnell and her colleagues Drs. Bélanger (Université de Sherbrooke) and Brunet (University of Ottawa) in *Pediatric Exercise Science* in 2015. By examining the many barriers that children have towards physical activity, they were able to classify them into two categories. Internal barriers are personal thoughts and emotions such as "I am not good at it" or "I don't enjoy exercise." On the flip side, external barriers are variable and tend to come from outside of the child: bad weather or lack of proper equipment, for example.

Her research team found when children perceived fewer internal barriers it related to higher physical activity. Simply put, where there's a will there's a way. Parents need to focus on removing internal barriers because they are the types of barriers that relate to physical activity.

So, how do we influence these internal barriers?

Dr. Gunnell and her colleagues published yet another study last year, this time in the highly-respected journal *Health Psychology.* The paper entitled, "A Tale of Two Models: Changes in Psychological Need Satisfaction and Physical Activity Over 3 Years," focused on the motivational role of psychological needs.

"We know that kids should be more active but we don't always know how to make that happen," she notes. "Our research identifies the specific factors we should target. By reframing our conversations with our children and supporting them in a way that actually gets them to be active on their own — it will lead to more lifelong participation."

Dr. Gunnell applies "Self-Determination Theory" to her research on physical activity and motivation. It suggests that all people are born with the psychological needs of competence, autonomy, and relatedness. If these needs are met, then people will develop into well-functioning happy adults. Using this theory, she and her team postulated that if these needs are met while doing physical activity, then children will gravitate towards these activities rather than ones that don't satisfy their needs.

Competence is when children feel they are able to succeed at optimally challenging tasks. "To meet their needs for competence, you need them doing activities at their own comfort level — not their friend's," advises Dr. Gunnell. "Especially in tasks they haven't done before, they need to start at a low level and experience small steps as they continue to improve."

For autonomy Dr. Gunnell suggests, "Give children a say and let them decide by providing options and allowing them to choose which physical activity they are naturally drawn towards. This will lead to genuine enjoyment since they are doing it for their own pleasure. For example, even non heartrate-increasing activities like bowling may cause a child to want to develop their muscles in order to be a better bowler. This has a spillover effect leading to interest in other activities that get their hearts pumping. If they feel they are doing it because you want them to, it undermines their autonomy and they may lose interest and enjoyment."

"Relatedness is achieved when your child has a sense of connection within their social circle. For instance, family activities such as walks or playing tag might nourish that in youngsters. As they age though, you might consider arranging high-energy outdoor activities with their peers to nurture that feeling of connection. When physical activity makes children feel connected, they will start to integrate it into their own internal types of motivation."

Dr. Gunnell's team assessed grade 5-6 children every four months for three years as part of a larger cohort study led by Dr. Bélanger. As predicted, they found that physical activity increased when psychological needs were met. They also discovered that children are not destined to follow a set path. What they were experiencing in the earlier grades did not predict levels of physical activity as they aged. This is the good news for parents, because there is room to intervene.

Dr. Gunnell's research helps children become healthier, happier, self-motivated, and active at the same time. Keep an eye out for her future research looking at the dynamics of motivation in children in relation to screen-time.

#eatingdisorders

When your doctor tells you that regular family meals are important, you will likely nod your head because you inherently know that it makes sense. You may increase the time you spend eating with your children based on that advice, but do you ever wonder why doctors say what they do?

Well, when CHEO's Dr. Norris makes his recommendations they come from a soft voice, but the message is confident and strong. He will give you the scientific evidence – because he has done the research.

"Research has really influenced the way in which the [eating disorders] clinic has evolved. It drives what we do. There's no doubt in my mind that research improves the quality of care our patients get," reflects Dr. Norris. "I know this because research has made me a better physician. It's increased my knowledge, it's increased my understanding, and I think it's made a huge impact on the conversations I am able to have with my patients."

Take, for example, the notion of regular family meals. Published in Canadian Family Physician in 2015, Dr. Norris co-authored a study entitled, "Systematic review of the effects of family meal frequency on psychosocial outcomes in youth." Synthesizing the results of related studies, he and his team found that frequent family meals led to increased self-esteem, commitment to learning, and higher grade point averages. They were also inversely associated with eating disorders, substance abuse, violent behaviour, and feelings of depression or thoughts of suicide.

"I can honestly say that almost all of my research is based upon my clinical experience," Dr. Norris says. "I see a patient or start to notice trends in the clinic and then I start to have questions. So the first thing is I do is go into the literature to understand what's there. If the question has not been answered in a sufficient and systematic way, then we set out and do that, working from the ground up."

This is exactly the process that that led to one of Dr. Norris's many 2015 research accomplishments. His team published a review article entitled, "Gastrointestinal Complications Associated with Anorexia Nervosa: A Systematic Review" in the esteemed International Journal of Eating Disorders. One of the common themes Dr. Norris noticed in some his patients with anorexia nervosa was the gastrointestinal issues they were encountering when they were trying to restore their body weight through eating. This review allowed him to systematically consider previous studies in the refeeding journey and as a result, they learned more about existing interventions and medications.

"A big part of what we do is education; we are invested in giving patients the complete picture. This review has helped us in the clinic to inform patients and equip them to make decisions based on the evidence."

Dr. Norris is not only helping CHEO patients with anorexia nervosa, bulimia nervosa and Avoidant Restrictive Food Intake Disorder (ARFID), he is committed to bringing a better understanding about eating disorders to the rest of Canada. Eating disorders, including ARFID are relatively under-recognized diseases and research is still in its infancy as far as basic understanding. Despite its media presence in the past few years, there is so much more research that needs to be done on eating disorders. Working with the Public Health Agency of Canada (PHAC) and the Canadian Pediatric Surveillance Program, Dr. Norris is trying to better understand the epidemiology of eating disorders including ARFID in Canada with the hopes of eliciting change and influencing policy. "There's a research mandate at CHEO, but there's also a greater mandate to try and bring new understanding and recognition of what eating disorders are to help people who need it."

Based on the evidence, Dr. Norris has had a busy, successful year conducting research at CHEO.

#cancer

After 15 years of intense investigation at the Children's Hospital of Eastern Ontario Research Institute, using viruses to treat cancer is no longer just a theory. CHEO's Dr. David Stojdl is at the forefront of this ground-breaking research that uses viruses to stimulate a patient's own immune system against their tumour in an approach known as "oncolytic immunotherapy" that is poised to revolutionize cancer treatment.

Dr. Stojdl first discovered that Maraba virus could be used to treat cancer in 2010. After five years of aggressive clinical development, Maraba virus has entered into a first of its kind human clinical trial at The Ottawa Hospital. The Maraba trial has been launched in adult cancer patients, which is an internationally recognized critical step before testing can begin in pediatric patients. The trial combines two viruses that not only kill cancer cells, but also trigger the body to produce an anti-cancer immune response. The first virus, an Adenovirus (similar to the one that causes the common cold), primes the body's immune system to begin recognizing the cancer; the second virus, Maraba virus, simultaneously boosts the anti-cancer immune response established by the Adenovirus, and directly kills cancer cells, leaving surrounding healthy cells untouched. One of the anticipated benefits of this therapy, which uses "biology to fight biology", is that it may have fewer serious side effects than current cancer treatments. Patients in advanced stages of cancer that haven't responded to conventional treatments have been enrolled in this trial, which is well under way.

"We are attempting to do these investigations using tools that don't require surgery or radiation. What we're hoping – at a minimum – is that quality of life will be better for patients. Of course we're reaching for a cure, but influencing quality of life would have a massive impact," says Dr. Stojdl.

Dr. Stojdl is vigorous in his biotherapy quest. He is already applying the experience he has gained from the Maraba clinical trial to another type of cancer: glioblastoma, or brain cancer. Every year, more than 10,000 Canadians are diagnosed with brain cancer, and most survive for only 18 months after diagnosis.

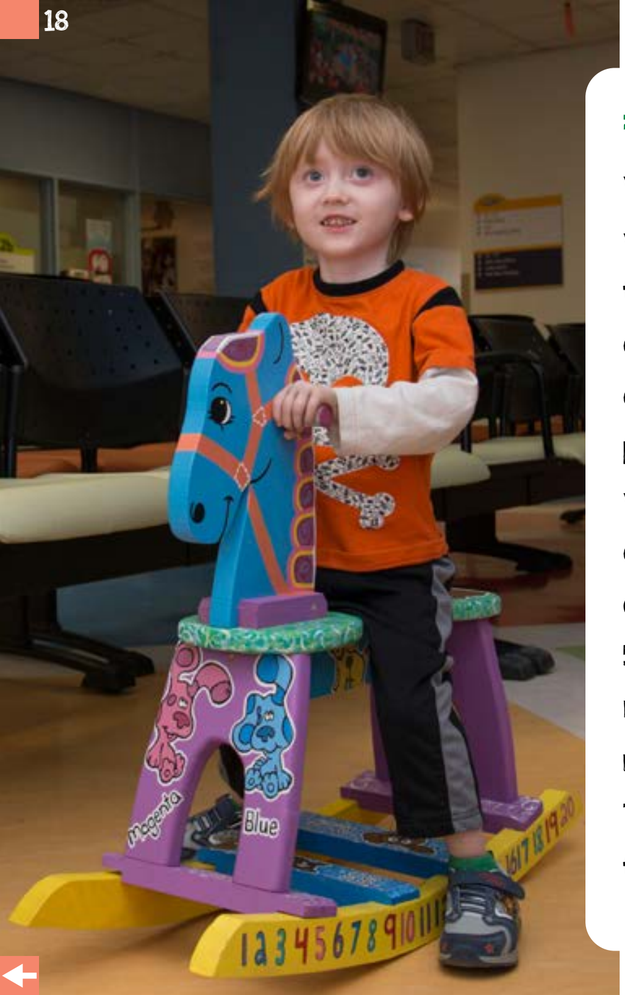
In 2010, Dr. Stojdl discovered that Farmington virus – a rhabdovirus similar to Maraba - could not only effectively kill brain cancer cells, but, unlike Maraba, was also safe to inject

directly into the brain. Working tirelessly for the past five years, he has designed Farmington virus so that, like Maraba, it also triggers the patient's immune system to fight the cancer. What shows real promise though, is that Farmington virus can also kill the root cause of brain tumours - the brain tumour-initiating cells- so that the cancer doesn't grow back after treatment.

"We are attempting to do these investigations using tools that don't require surgery or radiation. What we're hoping — at a minimum — is that quality of life will be better for patients. Of course we're reaching for a cure, but influencing quality of life would have a massive impact,"

Farmington is now ready for clinical trial.

"The tools that are being built in labs like ours at CHEO and around the world, I think, will change fundamentally how people approach the disease, the management of the disease, and the general outlook of the disease," declares Dr. Stojdl. "Healthcare advances as science advances, and the field of immunotherapy is at a tipping point. It's a race – not if, but when – virus therapy is going to become a standard of care."



#raredisease

What if you knew something was medically wrong with your child but nobody could tell you what it was? You take your child from doctor to doctor yet they can't pinpoint what it could be. But your parental instinct is strong – if only there was a way to find out. Over half a million children in Canada are affected by a rare disease; 25% of rare disease patients wait 5-30 years for a diagnosis, 40% initially receive a misdiagnosis, and about half will never receive a diagnosis.

That's where this story takes a turn – for the better. There is hope.

There are answers.

CHEO's Care4Rare research program, developed by Drs. Kym Boycott and Alex MacKenzie, is changing those statistics – one child at a time. Considered pioneers in genomics and personalized medicine, this internationally-renowned group of 80 physicians and 50 scientists are located in 21 academic sites across Canada. Using the cutting-edge technology of Whole Exome Sequencing (WES), the team is able to identify potential rare disease genes and then prove their importance in human health within the laboratory faster than ever before. Contributing to their success is the work they've done to create a global database called PhenomeCentral, which identifies rare disease patients that share clinical features and genetic data and may have the same undiagnosed rare disease awaiting discovery.

Over 1,000 families have already received a genetic diagnosis, and in the process, the Care4Rare research team has discovered over 85 novel rare disease genes!

"She was the first doctor we saw who really gave us a sense of hope that we would actually be able to get a diagnosis for our daughter," says a mom of one of Dr. Boycott's patients.

This life-changing research using innovative technology has transformed patient interactions in the clinic at CHEO and around the world. Children can now come into the clinic; take a DNA test; and receive not only a quick, but more importantly, an accurate genetic diagnosis for their rare disease. Those that don't are typically enrolled in a study which adds their clinical and genetic profile to a global data set via PhenomeCentral – increasing their odds to find answers through matchmaking with other rare disease patients around the world.

Receiving an evidence-based diagnosis is important for patients and families so they can access services in hospitals and schools, start disease-specific treatments, and become part of a worldwide community of children with the same rare condition. But sadly, only 5% of children with rare diseases have access to a disease-modifying treatment. Care4Rare aims to develop individualized and innovative therapies and is currently testing three new treatments in its laboratory at CHEO.

With over 45 peer-reviewed publications in 2015 alone and their matchmaking system heralded by MITs Technology Review as one of the "Top 10 Breakthrough Technologies in 2015," the Care4Rare team is on a roll – and gaining momentum. Last year alone, Care4Rare received a share of $28.5 million from the Canada Foundation for Innovation (CFI) and a share of another $26.9 million from Ontario Research Fund – Infrastructure Project. These funds will help even more children with rare diseases get diagnosed, and move new treatments into clinical trial.

Even with international acclaim and never-ending demands from the Care4Rare program, Dr. Boycott wants to stay on the frontlines and be a part of these families' lives.

"I love my clinical work," she says. "Many times, it has been suggested to me that I don't have time for clinical work anymore. I need to focus more on the research program which, of course, comes with numerous commitments. But I say the same thing every time, 'I will not give up the patients.' The patients make my work meaningful. Without them, there's no purpose."

#trainees

The CHEO Research Institute offers a rich and vibrant learning environment for advancing skills and knowledge in the pediatric realm. In proud partnership with the University of Ottawa, our academic goals are to educate and train students in an environment that promotes a vigorous pursuit of research excellence.

Our trainees are actively involved across all aspects of research at CHEO, working in both clinical settings and in laboratories.

We take great pride in offering the next-generation of clinical investigators and scientists with unlimited access to mentorship, state of the art technologies, and a unique range of research support services from statistical analysis to mining for funding opportunities.

"I was so excited to win the best poster award at Resident Research Day in 2015. My project was entitled, "Evaluating admissions and medical emergency team utilization in patients requiring chronic airway and/or ventilator support". I developed the protocol for this project with my supervisors, Drs. Dayre McNally and Anna-Theresa Lobos. Our study demonstrated that the number of Chronic Airway and/or Ventilatory Support (CAVS) patients admitted to hospital has more than doubled in recent years. Furthermore, we showed that when compared to other children, the CAVS children were 5 times more likely to have an intervention by the medical emergency team (MET). The results were considered with great interest by CHEO and we are excited to say that the study has already impacted how we provide care to this vulnerable population - with more positive change coming in 2016. I have felt very supported in my research endeavours by everyone involved including the ICU, the Department of Pediatrics, the CHEO Research Institute and the hospital as a whole."

Dr. Brianne McKelvie

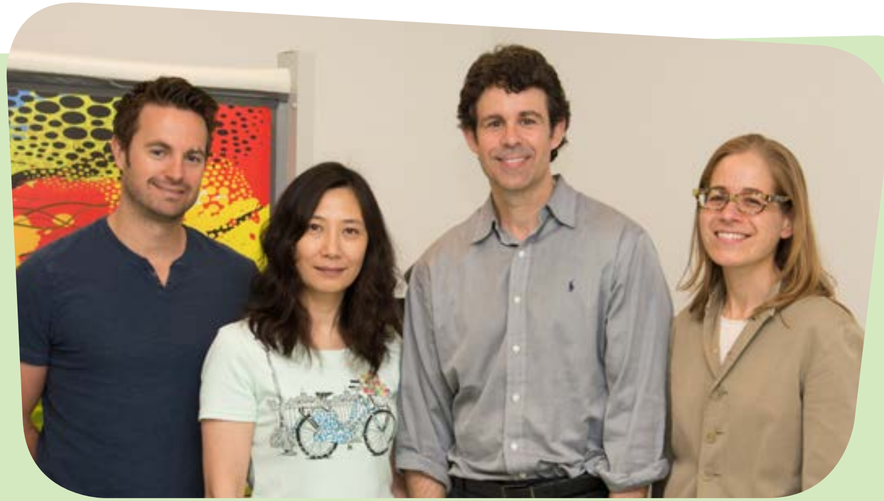
"I was delighted to receive the Serge Taillon Prize for best presentation at the CHEO Research Institute Summer Studentship Day in 2015. My project was entitled, "A Scoping Review of Pediatric Clinical Trials Administering High Dose Vitamin D." I worked on this project under the guidance of my supervisor, Dr. Dayre McNally. We performed a systematic review with the goal of finding every published clinical trial reporting on high dose vitamin D in children. As a result, we identified over 150 clinical trials! Recognizing that the list of trials and their results are useful to clinicians, researchers and/or policy-makers, we also created an open-access online searchable database. We believe this tool will not only advance research in the field, but prove to be a useful resources for clinicians too. Throughout my research project, I was supported by CHEO staff and faculty. Everyone here understands the importance of research and innovation to further improve our clinical practice and provide better care for children in the community."

Dr. Nassr Nama

Highlights

Maras D, Flament MF, Murray M, Buchholz A, Henderson KA, Obeid N, et al. *Screen time is associated with depression and anxiety in Canadian youth.* Prev Med 2015; 73: 133-8.

"We discovered that duration of sedentary screen time, primarily in the form of video games and recreational computer time, was associated with more severe symptoms of depression and anxiety in a large sample of Canadian adolescents. This suggests that screen time may represent a risk factor or marker of these psychiatric disorders among youth."



Goldfield GS, Kenny GP, Alberga AS, Prud'homme D, Hadjiyannakis S, Gougeon R, et al. Effects of aerobic training, resistance training, or both on psychological health in adolescents with obesity: The HEARTY randomized controlled trial. J Consult Clin Psychol 2015; 83 (6): 1123-35.

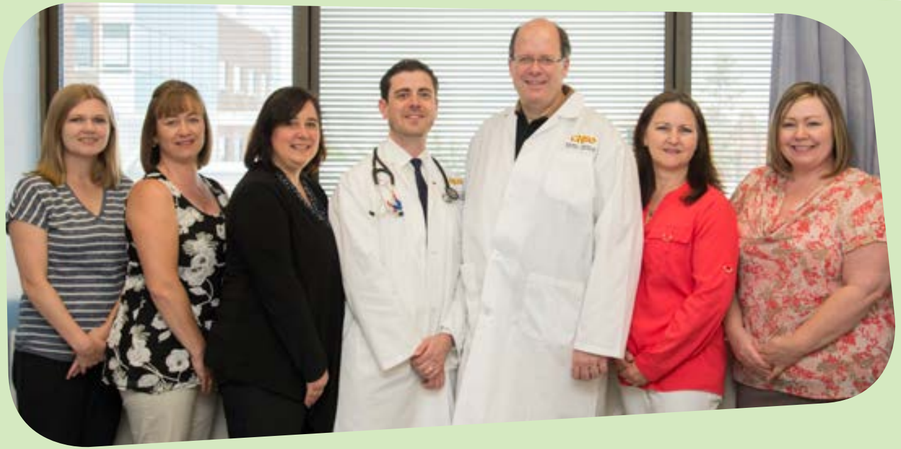
"We discovered that weight-training, alone or in combination with aerobic training, provides psychological benefits in adolescents with obesity, and therefore may represent a viable alternative to aerobic training alone in the biological and psychological management of adolescent obesity."

Faye MD, Beug ST, Graber TE, Earl N, Xiang X, Wild B, Langlois S, Michaud J, Cowan KN, Korneluk RG, Holcik M. IGF2BP1 controls cell death and drug resistance in rhabdomyosarcomas by regulating translation of cIAP1. Oncogene 2015; 34 (12): 1532-41.

"Our team discovered that an RNA binding protein (called IGF2BP1) which is normally not expressed in muscle cells, is highly expressed in common childhood muscle cancers (rhabdomyosarcoma) where it promotes expression of a protein (called cIAP1) that allows cancer cells to resist treatment. We also showed that targeting cIAP1 with a small molecule inhibitor delays tumour growth and improves survival in mouse model of rhabdomyosarcoma, advocating for this approach as a potential therapy."

Cummings EA, Ma J, Fernandez CV, Halton J, Alos N, Miettunen PM, et al. Incident Vertebral Fractures in Children With Leukemia During the Four Years Following Diagnosis. J Clin Endocrinol Metab 2015; 100 (9): 3408-17.

"Our team discovered that 26% of children with acute lymphoblastic leukaemia will have a spinal fracture due to osteoporosis in the 4 years following leukaemia diagnosis. We also determined that the child's bone health status at the time of diagnosis most strongly predicted whether new vertebral fractures would occur over the following 4 years."



Benchimol EI, Mack DR, Guttmann A, Nguyen GC, To T, Mojaverian N, et al. Inflammatory bowel disease in immigrants to Canada and their children: a population-based cohort study. Am J Gastroenterol 2015; 110 (4): 553-63.

"Our team discovered that Canada has one of the highest rates in the world of Inflammatory Bowel Disease (Crohn's and colitis) and while immigrants to Canada have lower rates of IBD compared to Canadian-born residents, that risk goes up in immigrants who are younger at arrival to Canada. In addition, Canadian-born children of immigrants from some regions have a higher risk of developing IBD."

Murto K, Lamontagne C, McFaul C, MacCormick J, Ramakko KA, Aglipay M, et al. Celecoxib pharmacogenetics and pediatric adenotonsillectomy: a double-blinded randomized controlled study. Can J Anaesth 2015; 62 (7): 785-97.

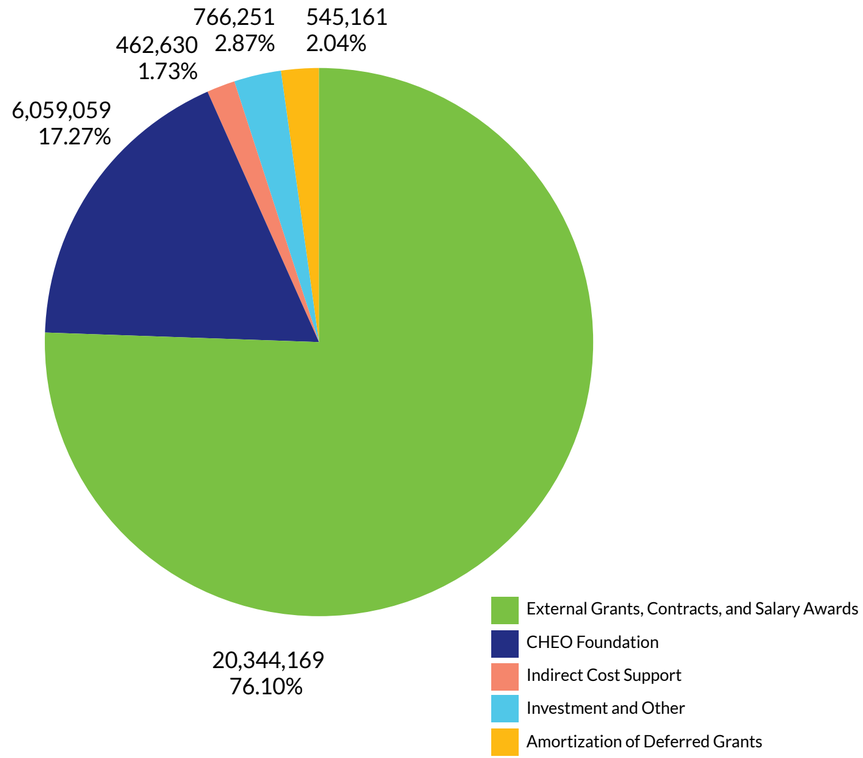
"Our team discovered that an adult-based three-day course of an oral celecoxib suspension combined with usual pain medications resulted in a modest but clinically meaningful reduction in early post adenotonsillectomy pain in children. Celecoxib was well tolerated and preliminary findings suggest that the CYP2C9*3 gene allele is responsible for improved celecoxib pain relief and quality-of-life recovery.Further dose-finding studies are warranted to account for underlying genetics and celecoxib's faster body-clearance in children compared with adults."

Funding Sources

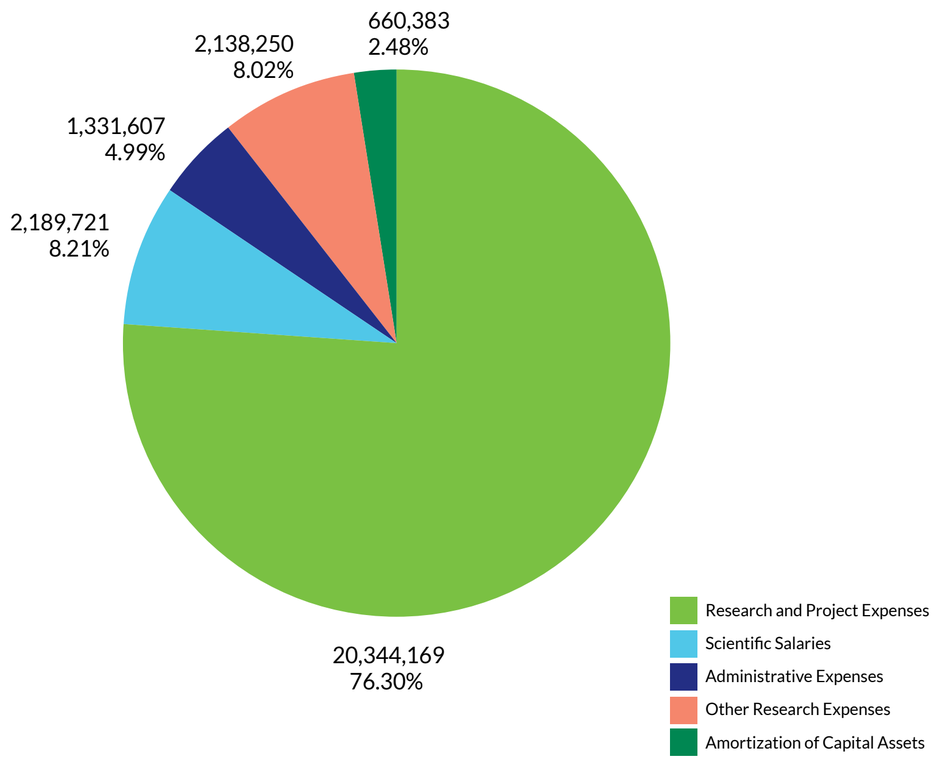
CHEO Foundation	$6,059,059.57
Canadian Institutes of Health Research	$4,741,283.39
Department of Pediatrics	$4,408,905.32
Ministry of Health and Long Term Care	$1,806,576.04
Other	$1,251,049.68
Canadian Foundation for Innovation	$1,036,596.36
CHEO Surgery Associates	$629,461.71
Genome Canada	$522,414.73
Juvenile Diabetes Research Foundation	$414,860.11
Public Health Agency of Canada	$407,642.34
CHAMO Innovation Fund	$334,452.80
Ontario Institute for Cancer Research	$317,983.17
Canadian Cancer Society Research Institute	$317,733.28
Participaction	$304,261.34
CHEO Research Institute	$304,233.97
Heart and Stroke Foundation of Canada	$242,924.32
Children's Hospital of Eastern Ontario	$213,766.80
Governement of Quebec	$198,395.96
Pfizer Inc.	$197,628.06
Clinical Research Unit	$192,110.93
CHEO Psychiatry Associates	$178,229.25
Cancer Research Society	$176,783.37
Natural Sciences and Engineering Research Council	$124,039.28
Ontario Trillium Foundation	$118,337.12
University of Ottawa	$111,637.16
Physicians Services Incorporated Foundation	$92,971.52
Jesse's Journey	$91,560.49
Ontario Neurotrauma Foundation	$80,054.06
Hospital for Sick Children	$73,536.28
Ottawa Hospital Research Institute	$71,898.65
Prostate Cancer Canada	$68,254.69
Alberta Innovates Health Solutions	$67,505.75
C17 Research Network	$66,605.99
Canadian Pediatric Society	$66,462.99
Crohn's and Colitis Foundation of Canada	$55,707.50
Mito Canada	$55,689.49
Networks of Centres of Excellence of Canada	$54,000.37
Lawson Foundation	$52,081.65
Mitacs Canada	$51,963.12
Terry Fox Foundation	$50,577.40
Ontario Brain Institute	$43,725.66
University of Guelph	$43,269.30
J.P. Bickell Foundation	$40,352.85
National Capital YM/YWCA	$39,370.85
Eli Lilly Canada Inc.	$38,136.34
Boehringer Ingelheim	$34,780.09
ACH Research Institute	$34,125.19
CHEO Laboratory Physicians and Scientists Associates	$33,833.34
National Institutes of Health MedBuy Corporation	$26,607.89
Canadian Cancer Society	$24,302.42
Janssen Pharmaceuticals Inc.	$22,084.21
Canadian Urological Association Scholarship Foundation	$21,345.03
Population Health Research Institute	$21,294.87
Ontario Cancer Biomarker Network	$21,055.66
Provincial Centre of Excellence for Child and Youth Mental Health	$20,815.16
University of Calgary	$19,236.70
Dystonia Medical Research Foundation	$18,760.21
Pennington Biomedical Research Centre	$18,731.42
Diabeaters Inc.	$16,729.22
Leukodystrophy Foundation	$15,015.08
London Health Sciences Centre	$14,973.71
Women's College Hospital	$14,171.46
Canadian Diabetes Association	$12,539.40
Canada Foundation for Women's Health	$11,997.15
Mach-Gaensslen Foundation of Canada	$11,212.29
Novartis	$10,063.78
Biomarin Pharmaceutical Inc.	$9,466.91
Ministry of Research and Innovation	$9,227.59
Department of Pathology	$9,129.67
Northern Ontario Academic Medicine Association	$8,164.82
Heart and Stroke Foundation of Ontario	$6,487.81
Bristol-Myers Squibb	$6,384.00
Epilespy Canada	$4,492.04
CHEO Department of Genetics Professional Associates	$4,484.53
Ottawa Hospital Department of Pathology and Laboratory Medicine	$4,111.09
Canadian Centre for Vaccinology	$3,994.80
Canadian HIV Trial Network	$3,836.95
Grand Challenges Canada	$3,707.00
Canadian Association of Pediatric Surgeons	$3,461.38
Abbott Laboratories Limited	$3,421.05
ARSACS Foundation	$3,412.52
Canadian Foundation for Women's Health	$3,342.17
Pharmaxis Limited	$3,315.22
Genzyme	$3,170.27
Amgen	$3,108.58
Ottawa Children's Treatment Centre	$2,538.70
The Arthritis Foundation	$2,132.37
Pediatric Oncology Group of Ontario	$2,102.00
Canadian Association of Genetic Counsellors	$1,972.32
Hoffman-La Roche Limited	$1,417.74
FightSMA	$1,399.49
Bayer Healthcare AG	$1,258.16
Provincial Health Services Authority	$1,163.53
Mental Health Commission of Canada	$439.15
The Council of Academic Hospitals of Ontario	$293.42
Baxter Innovations GmbH	$265.55
Versartis Inc.	$209.90
Canadian Association of Emergency Physicians	$100.00
Sharre Zedek Medical Centre	$40.00
Octapharma Canada Inc.	$26.00
PrioNet Canada	$7.32
	$26,377,732.06

Financial Reports

Revenue Distribution 2015-2016



Expenditure Distribution 2015-2016



More information

@CHEOhospital
#cheoresearch

@Alqurashi_w
@KatieGunnell
@StojdlLab
@C4RCanada
@HALOresearch
@CHEOibd
@ericbenchimol
@CHEOpediatrics
@AlexMunterCHEO

@uOttawaMED
@uOttawaResearch
@uOttawaBMRI

CHEO
RESEARCH INSTITUTE

Mailing address:
CHEO Research Institute
c/o RI Administration Offices
401 Smyth Road
Reseach Building 2,
2nd floor, Room 2119
Ottawa, Ontario
K1H 8L1

Phone: 613-737-7600

www.cheori.org

Design by Smiling Cat Inc
Photography by CHEO Media House