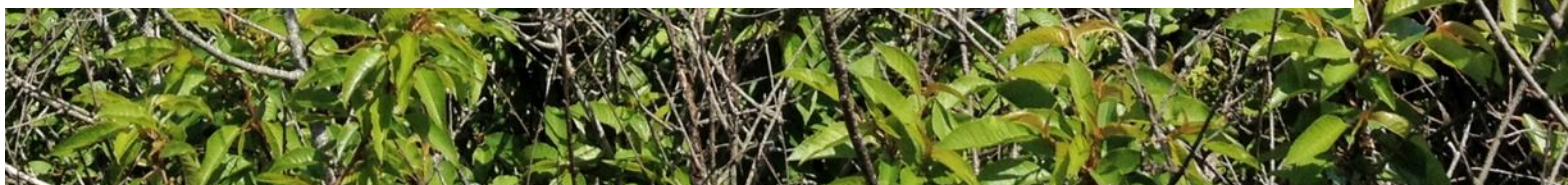




PERINATAL EPIDEMIOLOGY RESEARCH UNIT
DALHOUSIE UNIVERSITY AND IWK HEALTH CENTRE

PROGRESS REPORT 2010-2013





INTRODUCTION

PERU is the Perinatal Epidemiology Research Unit at Dalhousie University and the IWK Health Centre in Halifax, Nova Scotia. PERU is dedicated to promoting women's and children's health and wellbeing through research and through teaching the next generation of physicians and investigators.

With a team of leading researchers and access to one of the world's longest-running, most extensive perinatal databases as well as other comprehensive datasets, the unit provides insight into pressing issues in women's and children's health. These include the growing problems of obesity and exposures to environmental toxins.

Through its findings, the PERU research team influences public policy and clinical practice to protect and improve the health of women and children in the Maritimes and beyond.

A NOTE FROM PERU'S DIRECTOR, DR. LINDA DODDS



It is my pleasure to present this report for the Perinatal Epidemiology Research Unit (PERU). Launched in 1999, PERU is co-funded by the departments of Obstetrics & Gynaecology and Pediatrics. In 2010, I took over as director from Dr. Alec Allen, PERU's founding director. After a very successful first 11 years, it was no easy task to ensure the unit's continued success. My

first order of business was to find a replacement for Dr. KS Joseph, who moved to Vancouver in 2009, and to fill the vacancy left when I took on the director's role. We were very fortunate to fill these positions with two exceptional epidemiologists, Drs. Stefan Kuhle and Christy Woolcott. We were also fortunate to have Dr. Bill Gardner join PERU on a part-time basis in 2011. Dr. Alec Allen continues in the important role of chairing the Joint Data Access Committee, which reviews all proposals for data linkage studies involving the Nova Scotia Atlee Perinatal Database.

PERU's primary mandate is research, with a focus on maternal and fetal exposures and health outcomes in later life. We are fortunate to have access to world-renowned databases, which serve as the core of much of the unit's research. Specifically, the Nova Scotia Atlee Perinatal Database was the first provincial population-based perinatal database in Canada. With data going back to 1980, and the ability to link to other databases to capture longitudinal health information, we have many opportunities to study the consequences of pregnancy conditions on long-term maternal and offspring health. PERU researchers are capitalizing on excellent database resources in Nova Scotia and successfully securing grant funding to answer important questions utilizing these databases.

In the past few years, PERU members have become increasingly involved in supervising and teaching graduate students, medical students and residents within the departments of Obstetrics & Gynaecology and Pediatrics. Among numerous activities, we've launched a perinatal epidemiology journal club specifically for PERU trainees. Our members have also been heavily involved in developing the curriculum for Dalhousie Medical School's new Research in Medicine initiative. Starting with the 2013 incoming class, all

medical students will complete a research project during medical school. The PERU faculty will play a key ongoing role in Research in Medicine, teaching fundamental research skills to the medical students.

PERU provides research consultation for IWK researchers. Dr. Colleen O'Connell provides support for research design, statistical consultation and analyses. We are very appreciative of the support from IWK Research Services and the departments of Obstetrics & Gynaecology and Pediatrics, which enables researchers to receive consultations regarding their projects and allows trainees to receive analysis support. Analysis services are available to others with grant-funded research.

We are grateful for the exceptionally collegial environment within the departments of Obstetrics & Gynaecology, Pediatrics and Community Health & Epidemiology, and look forward to continued productive collaborations with members of all three of these departments. We hope that the next five years will bring further success in obtaining research funds, despite a very competitive funding environment, and that we continue to attract excellent trainees into our unit. Together, with our fellow unit members, trainees and collaborators, we look forward to shedding more light on pressing maternal and child health issues in our society.

A handwritten signature in black ink that reads "Linda Dodds". The signature is written in a cursive, flowing style.

EXPLORING THE IMPACT OF PREGNANCY-RELATED WEIGHT GAIN



Pregnancy is a pivotal point in women's lives that for some may literally tip the scales toward a less healthy future for both the women and their children. Particularly if women are already overweight at the beginning of pregnancy, PERU researchers have found they are more vulnerable to gaining more weight than recommended during pregnancy.

"We've found that 46 per cent of women in Nova Scotia are overweight or obese at the beginning of their pregnancy, and that 60 per cent gain more than the recommended amount of weight in their pregnancy," says PERU epidemiologist Dr. Christy Woolcott. "Our analysis also shows that many women do not lose the extra weight post-partum, and they end up accumulating weight from pregnancy to pregnancy."

Pregnancy-related weight gain has serious implications for the immediate and long-term wellbeing of mother and child. As Dr. Woolcott explains, women who are overweight or obese during pregnancy face a higher risk of gestational diabetes and pre-eclampsia (pregnancy-related high blood pressure). They are also more likely to have complicated labour and require a caesarean section or other intervention to deliver the baby. Their babies are likely to be large for their gestational age and face an increased risk of growing up to be overweight, compared to the offspring of healthy-weight women.

But what is the effect of pregnancy-related weight gain on the future health of women? Dr. Woolcott and PERU colleagues Drs. Linda Dodds and Stefan Kuhle have joined forces with colleagues at Dalhousie University and the IWK to find out. They're linking pregnancy data from the Nova Scotia Atlee

Perinatal Database to comprehensive health data collected through the Atlantic PATH longitudinal cohort study, to see to what extent excessive pregnancy weight gain predisposes women to obesity, cardiovascular disease, diabetes and other chronic diseases later in their lives.

The researchers hope their findings will give impetus to public and professional education programs aimed at ensuring women understand why it's so important to enter pregnancy at a healthy weight and to avoid gaining too much during pregnancy.

"The national guidelines on gestational weight gain need to be communicated more clearly, so women understand how much they should gain at each stage of their pregnancy," Dr. Woolcott says. "If they're already obese at the outset of the pregnancy, they should gain very little throughout."

Dr. Woolcott and colleagues in PERU and the Department of Obstetrics & Gynaecology are exploring the possibility of forming a large, multi-disciplinary research group to address the complex issues that surround pregnancy, overweight and obesity, and women's and children's health. "Our goal in PERU is to provide the evidence and a sense of urgency to support comprehensive efforts to change the culture in our society," she says, adding that, "We need more emphasis on physical activity, as well as healthy eating, and we should be assessing women's risk of chronic disease at a much younger age, so they have time to act to reduce their risk."

EXAMINING THE EFFECTS OF CHEMICAL EXPOSURES ON BABIES' AND CHILDREN'S HEALTH

It's well known that chemicals are pervasive in our 21st century environment, but it's not widely known how exposure to these chemicals *in utero* and through breast milk affects the health and wellbeing of babies. A team of Canadian researchers, including PERU epidemiologist Dr. Linda Dodds, will shed light on this important issue when they release results of a massive nationwide Canadian Institutes of Health Research-, Ontario Ministry of Health-, and Health Canada-funded study involving more than 2,000 pregnant women and their babies.

"We enrolled pregnant women in the study from 2007 to 2010 and tested their blood and urine samples for indications of exposure to about 50 chemicals, including PCBs, heavy metals, flame retardants and plasticizers," says Dr. Dodds, who leads the Nova Scotia arm of the MIREC study (Maternal-Infant Research on Environmental Chemicals). "Once their babies were born, the cord blood and breast milk were tested for the same chemicals. The babies were assessed at birth and at six months for growth and other developmental milestones."

Health Canada is funding an extension of this study to look at the children's overall burden of environmental chemical exposure and measures of physical and neurological development. "We now have an incredible cohort, with detailed information about their prenatal and early childhood exposure to common chemicals, that we can follow to trace the long-term effects," Dr. Dodds says. "This is a unique opportunity."

Many of the chemicals the researchers are tracking are known to cause disruption to the endocrine system - for example, the plasticizers known as phthalates. Dr. Dodds recently received a grant from the Canadian Diabetes Association to see if early exposure to these chemicals may be linked to higher levels of fetal markers of metabolic dysfunction. "It may not be a coincidence that we've seen a sharp rise in the rates of obesity and type 2 diabetes since these chemicals were introduced," notes Dr. Dodds, who is also part of a team studying the effect of plasticizers on male reproductive health. "We need to know how these substances may be impacting human health so we can advise policymakers of potential hazards."



Dr. Dodds' research has already had an impact in reducing Nova Scotians' exposure to unhealthy drinking water. In the early 2000s, she found an association between by-products of water treatment - which occur when chlorine or other disinfectants mix with excessive organic matter in the water - and higher rates of stillbirths. In response to this and other reports suggesting adverse outcomes associated with high levels of disinfection by-products, governments upgraded water treatment systems across the province.

Not all environmental exposures in pregnancy are bad. Exposure to sunshine - or supplemental vitamin D in colder climates and seasons - may be vital to healthy pregnancies and babies. Dr. Dodds has launched a new study with colleagues in Quebec to learn how much vitamin D is optimal in pregnancy to prevent complications and the potential consequences of inadequate vitamin D exposure. Exposure to vaccines *in utero* also seems to be positive. Dr. Dodds and her colleagues have found that both mothers and babies seem to benefit from the influenza vaccine in pregnancy.

UNDERSTANDING THE CAUSES AND CONSEQUENCES OF CHILDHOOD OBESITY

Childhood obesity is on the rise in Nova Scotia. "A third of grade five students in Nova Scotia were overweight or obese in 2011," says Dr. Stefan Kuhle, a PERU epidemiologist who's exploring the root causes, current consequences and future costs of the childhood obesity epidemic. "Compared to 2003, just as many were overweight, and more were obese, in 2011."

Dr. Kuhle is working with Dalhousie University-IWK colleague Dr. Sara Kirk and University of Alberta researcher Dr. Paul Veugelers to analyze data collected through the Children's Lifestyle And School performance Study, which surveyed 5,000 Nova Scotia grade five students in 2003 (CLASS I) and again in 2011 (CLASS II), about their food intake, physical activity levels and health, including BMI. New questions added in 2011 about sleep and academic performance will shed light on the links between sleep, obesity, activity, nutrition, general health, and learning.

In addition to analyzing the children's data, Drs. Kuhle and Veugelers have linked it to the Nova Scotia Atlee Perinatal Database to see what maternal and perinatal factors may contribute to the rising rates of childhood obesity. "We found that maternal weight is the strongest determinant of childhood obesity," says Dr. Kuhle. "Children of obese mothers are four times more likely to be obese than peers born of normal-weight mothers." This association has serious implications for Nova Scotia, where the researchers have found that 46 per cent of women are overweight or obese at the beginning of their pregnancy and 60 per cent gain more weight in pregnancy than national guidelines recommend.

The impact of obesity on children's health - now and in the future - is enormous. By linking the 2003 children's health data to administrative health records, Dr. Kuhle has found that overweight and obese children have higher rates of asthma and other respiratory disorders, middle ear infections, mood disorders, and other health problems - and that they see their doctors and go to the hospital more often than their healthy-weight peers. In their analysis of the Canadian Health Measures Survey, he and colleagues at the University of Alberta found higher levels of such disease markers as cholesterol, triglycerides and C-reactive protein in overweight and obese children.



If they're having health problems now, how does the future bode for overweight and obese children? Dr. Kuhle is co-supervising Mark Staples, a student from Dalhousie University's Department of Industrial Engineering, to create a model that's mapping the trajectories of weight status in Canadians up to 15 years into the future. "We need to show policymakers what the impacts will be if the current trend continues," says Dr. Kuhle. "We need to show how investing in prevention now will pay dividends in the future."

It's crucial, however, to identify what prevention strategies work best. To that end, Dr. Kuhle is helping Dr. Kirk evaluate the impact of a health-promoting schools initiative in south-western Nova Scotia. "We want to learn what factors have the greatest influence on creating a school culture that embraces healthy behaviours," he says, noting that school-based initiatives are just part of the equation. "We need to include families and communities in a comprehensive effort to reverse the obesity epidemic."

PERU RESEARCHERS AND SUPPORT STAFF 2010-2013

DIRECTOR

Dr. Linda Dodds obtained a master's degree in biostatistics from the University of Washington and a PhD in epidemiology from the University of Toronto. Currently, Dr. Dodds is a professor in the departments of Obstetrics & Gynaecology and Pediatrics at Dalhousie University and the IWK Health Centre, with a cross-appointment to the Department of Community Health & Epidemiology. She has been the director of the Perinatal Epidemiology Research Unit since 2010. She was the director of research for the Department of Obstetrics & Gynaecology from July 2008 to June 2013. Her research interests include the fetal, newborn and long-term health impacts of maternal exposures to chemicals in the environment, optimal vitamin D status in pregnancy, and the outcomes associated with maternal influenza vaccination.



PAST DIRECTOR

Dr. Alexander Allen received an MDCM degree from McGill University and served as the director of the Perinatal Epidemiology Research Unit from its inception in September 1999 until he stepped down in June 2010. Dr. Allen is a professor in the departments of Pediatrics and Obstetrics & Gynaecology at Dalhousie University, former head of the Division of Neonatal-Perinatal Medicine at the IWK Health Centre, and former neonatal co-director of the Reproductive Care Program of Nova Scotia. He is currently chair of the Joint Data Access Committee of the Perinatal Epidemiology Research Unit, the Population Health Research Unit and the Reproductive Care Program of Nova Scotia.



EPIDEMIOLOGISTS

Dr. Christy Woolcott joined the Perinatal Epidemiology Research Unit in 2010. A graduate of the University of Waterloo (BSc), Queen's University (MSc) and the University of Calgary (PhD), Dr. Woolcott joined PERU after completing a postdoctoral fellowship at the Cancer Research Center of Hawaii. Christy's current research interests concern the role of pregnancy characteristics in maternal and child outcomes. Her projects focus on determining how much gestational weight gain contributes to the development of obesity and obesity-related conditions in mothers, and developing risk prediction tools for cardiovascular disease and type 2 diabetes mellitus using information about women's pregnancies.



Dr. Stefan Kuhle trained as a pediatrician at the Vienna University Children's Hospital in Austria. He completed a master's degree in clinical epidemiology in 2007, and a PhD in epidemiology in 2011, at the University of Alberta. Prior to joining PERU, he worked at the School of Public Health at the University of Alberta. Dr. Kuhle's research examines the impact of childhood obesity on the health status and outcomes of these children, and on health services utilization and costs to the system. He is also involved in an economic evaluation of school-based obesity prevention programs in Nova Scotia and Alberta and will explore maternal and fetal factors and their relationship to later child health.



HEALTH SERVICES RESEARCHER

Dr. Bill Gardner joined the Perinatal Epidemiology Research Unit in 2011 from the Nationwide Children's Hospital in Columbus, Ohio, where he continues part-time as a professor of pediatrics, psychology and psychiatry. Bill maintains his position as director of biostatistics in the research institute at Nationwide Children's Hospital. His research interests lie in pediatric mental health and the creation and use of health data partnerships in both Canada and the United States. Dr. Gardner worked with Drs. Adrian Levy and David Anderson to found the Maritime SPOR Support Unit (MSSU), a Canadian Institutes of Health Research-funded centre for health services research in the Maritime Provinces. He currently serves as the chair of the MSSU Science Committee.



RESEARCH ASSOCIATE

Dr. Colleen O'Connell received a master's and doctoral degree in psychology from Carleton University in Ottawa. Her PhD project explored the postnatal consequences of prenatal exposure to cannabis in school-aged children. Dr. O'Connell has since worked as the research coordinator for the Ottawa Prenatal Prospective Study and as a research analyst for the Reproductive Care Program of Nova Scotia. She is currently an adjunct assistant professor in the Department of Obstetrics & Gynaecology at Dalhousie Medical School, in addition to her consulting work with PERU.



ADMINISTRATIVE RESEARCH COORDINATOR

Janet Slaunwhite has provided administrative support to PERU since 2009. She is on a leave of absence until April 2014, and Catherine Bulger is filling in during her absence.

DATA ANALYST

Anne Spencer holds a BSc from Mount Allison University and an MSc in Community Health and Epidemiology from Dalhousie University. She has worked with PERU since 2008.

STUDY COORDINATORS AND RESEARCH ASSISTANTS

JoAnne Douglas worked with Dr. Christy Woolcott in 2012 and 2013 in assisting with groundwork for publications and grant submissions.

Kevin Wilson worked with Drs. Christy Woolcott and Linda Dodds between 2012 and 2013 on a meta-analysis of cardiovascular risk among mothers of preterm infants.

Li Li worked with Dr. Linda Dodds as a data analyst.

Tarra Penney worked with Dr. Stefan Kuhle in 2012 as a research assistant.

STUDY COORDINATORS FOR THE MATERNAL-INFANT RESEARCH ON ENVIRONMENTAL CHEMICALS (MIREC) STUDY

Kim Rinaldo, Katerina Allen

RESEARCH ASSISTANTS FOR THE MATERNAL-INFANT RESEARCH ON ENVIRONMENTAL CHEMICALS (MIREC) STUDY

Alison Gareau, Laura Gillis, Laurie Kay, Julia LeBlanc, Mary Claire Lynch, Kathy MacPherson, Glenn Patriquin, Lindsay Pickrem, Sharon Rushdi, Julia Tsyrlin, Brittany Web, Melanie Wilcox

PERU GRANT FUNDING 2010-2013

The PERU research team has continued to expand its network of collaborators, both within Dalhousie University and the IWK Health Centre and with researchers across the country, to address the multifaceted nature of such key issues as maternal and childhood obesity and the impact of environmental exposures on reproductive health and child outcomes. A strong teamwork approach has helped team members and their collaborators succeed in obtaining a large number of substantial grants.

Please note, in the listings below, members of the PERU research team are indicated in **bold**. Their colleagues at Dalhousie and the IWK are indicated in *italics*.

DO MATERNAL AND NEONATAL FACTORS PREDICT LONG-TERM CHILD HEALTH AND HEALTH CARE UTILIZATION?

Funding Agency: Canadian Institutes of Health Research
Years: 2013-2016
Amount: \$178,540
PIs: **Stefan Kuhle**
Co-investigators: **Christy Woolcott, Linda Dodds**, Sarah MacDonald, *Mohamed Abdolell*

DO PREGNANCY CHARACTERISTICS HELP TO PREDICT THE FUTURE RISK OF MATERNAL CARDIOVASCULAR OUTCOMES? A POPULATION BASED LONGITUDINAL COHORT STUDY

Funding Agency: Canadian Institutes of Health Research
Years: 2013-2016
Amount: \$180,021
PIs: **Christy Woolcott, Linda Dodds**
Co-investigators: *Trevor Dummer*, Sarah MacDonald, Hude Quan, *Mohamed Abdolell*

SCOTIA SUPPORT GRANT (TRAINEE SUPPORT)

Funding Agency: Nova Scotia Health Research Foundation
Years: 2013-2015
Amount: \$48,500
PIs: **Linda Dodds, Christy Woolcott**
Co-investigators: **Stefan Kuhle**

THE INFLUENCE OF COMPREHENSIVE SCHOOL HEALTH ON SCHOOL CULTURE AND HEALTH BEHAVIORS IN CHILDREN

Funding Agency: Canadian Institutes of Health Research
Years: 2013-2015
Amount: \$199,833
PIs: *Sara Kirk*, **Stefan Kuhle**
Co-investigators: Jane Cunningham, *Jessie-Lee McIsaac*, Lori Munro-Sigfridson, Arto Ohinmaa, *Tarra Penney, Cindy Shearer*, Kate Storey, Paul Veugelers

ALBERTA PHYSICAL ACTIVITY AND BREAST CANCER PREVENTION TRIAL: AN ANCILLARY STUDY EXAMINING ANTI-INFLAMMATORY MARKERS AND OXIDATIVE STRESS

Funding Agency: Canadian Cancer Society Research Institute
Years: 2013-2015
Amount: \$166,351
PI: Christine Friedenreich
Co-investigators: **Christy Woolcott**, Kerry Courneya, Don Morris, Mark Poulin, Yutaka Yasui

PREGNANCY CHARACTERISTICS AND MATERNAL LONG TERM WEIGHT-RELATED OUTCOMES: A COHORT STUDY

Funding Agency: Canadian Institutes of Health Research, Nova Scotia Health Research Foundation, Dalhousie University
Years: 2012-2015
Amount: \$215,468
PIs: **Christy Woolcott, Linda Dodds, Louise Parker**
Co-investigators: **Stefan Kuhle, Sara Kirk, Trevor Dummer, Anthony Armson**

EMERGING TEAM IN RARE DISEASES: ACHIEVING THE "TRIPLE AIM" FOR INBORN ERRORS OF METABOLISM

Funding Agency: Canadian Institutes of Health Research
Years: 2012-2017
Amount: \$1,490,490
PIs: Elizabeth Potter, Pranesh Chakraborty, Douglas Coyle, Jonathan Kronick, Kumanan Wilson
Co-investigators: **Linda Dodds, Annette Feigenbaum, Deshayne Fell, Michael Geraghty, Scott Grosse, Astrid Guttman, Julian Little, Aziz Mhanni, Fiona Miller, John Mitchell, Meranda Nakhla, Komudi Siriwardena, Kathy Speechley, Hilary Vallance, Brenda Wilson**

HEALTH CARE UTILIZATION AND HEALTH OUTCOMES IN NORMAL WEIGHT AND OVERWEIGHT CHILDREN IN NOVA SCOTIA

Funding Agency: IWK Health Centre Recruitment/Establishment Award
Years: 2012-2014
Amount: \$67,595
PI: **Stefan Kuhle**

IMPROVING HEALTH CARE DELIVERY IN TWIN PREGNANCIES BY DETERMINING OPTIMAL MATERNAL WEIGHT GAIN TO MINIMIZE INFANT AND MATERNAL RISKS (REDUCE NICU)

Funding Agency: Hamilton Academic Health Sciences Organization
Years: 2012-2014
Amount: \$76,708
PI: Sarah McDonald
Co-investigators: **Christy Woolcott, Linda Dodds, Anthony Armson, Lucy Giglia, Joseph Beyene**

WHAT IS THE IMPACT OF PRENATAL EXPOSURE TO MULTIPLE ENVIRONMENTAL CONTAMINANTS ON NEWBORN IMMUNE SYSTEM DEVELOPMENT?

Funding Agency: IWK Health Centre and Atlee Foundation
Years: 2012-2013
Amount: \$10,265
PIs: **Jillian Ashley-Martin** (PhD student), **Linda Dodds** (supervisor)
Co-investigators: *Jean Marshall, Adrian Levy*

VITAMIN D STATUS IN CANADIAN PREGNANT WOMEN AND THEIR NEWBORN INFANTS: WHAT LEVELS PROTECT AGAINST ADVERSE PREGNANCY OUTCOMES?

Funding Agency: Canadian Institutes of Health Research
Years: 2011-2013
Amount: \$233,622
PIs: **Linda Dodds, Yves Giguere**
Co-investigators: **Christy Woolcott, Anthony Armson, Jean-Claude Forest, Hope Weiler**

ENVIRONMENTAL CHEMICALS AND MATERNAL-FETAL MARKERS OF DIABETES, OBESITY AND METABOLIC DYSFUNCTION

Funding Agency: Canadian Diabetes Association
Years: 2011-2013
Amount: \$163,250
PI: **Linda Dodds**
Co-investigators: Tye Arbuckle, William Fraser, Mandy Fisher, Adrienne Ettinger, Shayne Taback, Patricia Monnier, Maryse Bouchard, Renée Dallaire, Erin Keely

PREGNANCY-RELATED EXCESS WEIGHT

Funding Agency: Canadian Institutes of Health Research
Years: 2011-2012
Amount: \$24,032
PI: *Helena Piccinini-Vallis*
Co-investigators: **Linda Dodds, Christy Woolcott**, Laura Gaudet, Sarah McDonald, Sonia Wicklum, David Macklin

RESEARCH PROGRAM IN TWO AREAS: PREGNANCY AND MATERNAL BREAST CANCER RISK, AND PHYSICAL ACTIVITY AND OBESITY IN PREGNANCY

Funding Agency: IWK Health Centre Recruitment/Establishment Award
Years: 2011-2012
Amount: \$48,821
PI: **Christy Woolcott**

A PILOT STUDY OF THE ASSOCIATIONS AMONG GHRELIN, ADIPOCYTOKINES, GLYCEMIC CONTROL AND ADIPOSITY-RELATED PERINATAL OUTCOMES

Funding Agency: IWK Health Centre
Years: 2011
Amount: \$3,555
PI: **Christy Woolcott**
Co-investigators: **Linda Dodds**, *Anthony Armson, Younes Anini*

RATES AND DETERMINANTS OF BREASTFEEDING INITIATION, DURATION AND EXCLUSIVITY IN NOVA SCOTIA

Funding Agency: Nova Scotia Health Research Foundation
Years: 2010-2012
Amount: \$85,660
PI: **Linda Dodds**
Co-investigators: Sonia Seminic, Janet Bryanton

TEAM DEVELOPMENT AWARD

Funding Agency: Nova Scotia Health Research Foundation
Years: 2010-2011
Amount: \$10,000
PI: **Linda Dodds**
Co-investigators: **Christy Woolcott**, *Louise Parker, Anthony Armson, Sara Kirk, Trevor Dummer*

INFLUENZA VACCINE IN PREGNANCY: HAS THE MESSAGE BEEN RECEIVED?

Funding Agency: IWK Health Centre and Atlee Foundation
Years: 2010-2011
Amount: \$6,327
PI: **Linda Dodds**
Co-investigators: *Noni MacDonald, Shelly McNeil, Jeffrey Scott, Victoria Allen*, Mark Walker

MATERNAL-INFANT RESEARCH ON ENVIRONMENTAL CHEMICALS (MIREC): A NATIONAL PROFILE OF IN-UTERO AND LACTATIONAL EXPOSURE TO ENVIRONMENTAL CONTAMINANTS - INFANT FOLLOW-UP

Funding Agency: Health Canada
Years: 2009-2014
Amount: \$1,799,800
PIs: Gina Muckle, Tye Arbuckle, William Fraser, Jean Sequin, Bruce Lanphear
Co-investigators: **Linda Dodds**, Dave Saint-Amour, Eric Dewailly, Patricia Monnier, Benoit Jutras, Christine Till, Michel Boivin, Ginette Dionne, Zong Cheng Luo, Shu Qin Wei, Warren Foster, Belkacem Abdous, Pierre Ayotte, Mark Walker

CIHR TEAM IN IMPACT OF EXPOSURE TO PHTHALATES, THEIR METABOLITES AND 'GREEN' PLASTICIZERS ON MALE REPRODUCTIVE HEALTH

Funding Agency: Canadian Institutes of Health Research

Years: 2009-2014

Amount: \$2,492,500

PI: Bernard Robaire

Co-investigators: **Linda Dodds**, Peter Chan, Barbara Hales, Makoto Nagano, David Cooper, Richard Leask, Jeffrey Nisker, Viviane Yargeau, Martine Culty, Milan Maric, Vassilios Papadopoulos, Roxanne Mykitiuk, Dayna Scott

MATERNAL-INFANT RESEARCH ON ENVIRONMENTAL CHEMICALS (MIREC): A NATIONAL PROFILE OF IN-UTERO AND LACTATIONAL EXPOSURE TO ENVIRONMENTAL CONTAMINANTS

Funding Agency: Canadian Institutes of Health Research, Health Canada, and Ontario Ministry of Health

Years: 2007-2012

Amount: \$5,203,208

PIs: Tye Arbuckle, William Fraser

Co-investigator: **Linda Dodds**, Jean-Philippe Weber, Melissa Legrand, Premkumari Kumathasan, Renaud Vincent, Zhong-Cheng Luo, Adrienne Ettinger, Robert Platt, Grant Mitchell, Kevin Cockell, Maya Villeneuve, Sheryl Tittlemier, Pierre Julien, Denise Avard, Nick Hidioglou (deceased), Hope Weiler, Alain LeBlanc, Mandy Fisher, Monique D'Amour, Peter von Dadelszen, Denise Hemmings, Jingwei Wang, Michael Helewa, Shayne Taback, Mathew Sermer, Warren G. Foster, Greg Ross, Paul Fredette, Graeme Smith, Mark Walker, Roberta Shear

TWIN BIRTH STUDY: A MULTI-CENTRE RANDOMIZED CONTROLLED TRIAL COMPARING PLANNED CAESAREAN WITH PLANNED VAGINAL BIRTH FOR TWINS AT 32-38 WEEKS GESTATION

Funding Agency: Canadian Institutes of Health Research

Years: 2003-2012

Amount: \$8,608,044

PI: Jon Barrett

Co-investigator: **Alexander Allen**, *Scott Farrell*, *Anthony Armson*, **KS Joseph**, Susan Ross, Mary E. Hannah, Eileen Hutton, Elizabeth Asztalos, Nanette Okun, Adam Gafni, Arne Ohlsson, Andrew Willan

PERU TEACHING ACTIVITIES 2010-2013

The members of PERU are involved in a wide variety of teaching activities. These faculty members teach courses in the undergraduate and postgraduate medical programs at Dalhousie University, while supervising graduate students, medical residents and fellows to conduct research projects of their own.

PROFESSIONAL COMPETENCIES 1

A foundational course for first-year medical students, involving several hours per week of small-group case-based instruction and discussion. PERU members serve as tutorial group leaders:

Linda Dodds: 2011-2012, 2013-2014

Christy Woolcott: 2011-2012, 2013-2014

Stefan Kuhle: 2012-2013

ADVANCED EPIDEMIOLOGY

A graduate-level elective offered by the Department of Community Health & Epidemiology on the design, conduct, analysis and interpretation of epidemiological studies.

Stefan Kuhle: co-taught winter term 2013

APPLIED STATISTICS FOR PERINATAL RESEARCH

A practical course for maternal-fetal medicine and neonatal-perinatal medicine fellows offered jointly through the departments of Obstetrics & Gynaecology and Pediatrics for the first time in the fall of 2011. The course was developed and facilitated by Linda Dodds, Christy Woolcott, and Colleen O'Connell.

ACADEMIC SKILLS COURSES

A series of research-skills courses for residents in the departments of Obstetrics & Gynaecology and Pediatrics, offered every January since 2010. The following sessions are taught by PERU members:

Statistics 1 and 2: Linda Dodds

Study Design: Christy Woolcott

Writing a Proposal: Linda Dodds

Systematic Reviews: Stefan Kuhle

SELECTED TOPICS IN EPIDEMIOLOGY AND BIostatISTICS

A self-directed reading course offered through the departments of Obstetrics & Gynaecology, Pediatrics, and Industrial Engineering.

Stefan Kuhle: co-taught winter term 2013-2014

DATA SOURCES IN EPIDEMIOLOGY

A module of the online 'Introduction to Research Methods' course (<http://researchmethods.dal.ca>) for medical residents. The course module, including slides and video presentation, was developed by Stefan Kuhle.

RESEARCH IN MEDICINE (RIM)

The Research in Medicine program is meant to develop medical students' skills of critical thinking and creativity through a mentored research project conducted longitudinally throughout the curriculum. Didactic courses will expose all students to essential research skills. PERU faculty are contributing to the program as lecturers, facilitators, and mentors.

Linda Dodds, Christy Woolcott, Stefan Kuhle: co-taught fall term 2013

RESIDENT HALF-DAY SESSIONS

A series of review sessions on critical appraisal, epidemiology, and statistics for residents in the Department of Obstetrics & Gynaecology is offered three times per academic year by Linda Dodds, Christy Woolcott, and Stefan Kuhle.

PERU JOURNAL CLUB

PERU faculty supervise a regular journal club for graduate students. Selected topics to date have included missing data, multi-level modelling, dose-response relationships, and effect modification.



The PERU journal club in action at a local coffee house.

PERU PUBLISHED MANUSCRIPTS 2010-2013

The past four years have been highly productive for PERU team members, with more than 100 papers published in peer-reviewed journals. Trainees were successful in their publication attempts as well (*indicates a trainee under the supervision of a PERU member).

2013

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PERU TRAINEES 2010-2013

Supervising students at all levels of their academic training is a key function of PERU faculty members. In the years from 2010 through 2013, they collectively supervised 12 graduate students, 5 medical students, 7 residents and 2 fellows. Unless otherwise indicated, the trainees are/were pursuing their studies at Dalhousie University.

Graduate students

[HONGQUN ZHANG](#) - MSc student, 2013-present

Department of Statistics

Thesis: Comparison of different machine learning methods for the prediction of neonatal outcomes from prenatal information

Dr. Stefan Kuhle, thesis co-supervisor

[DR. RODRIGO ROMAO](#) - MSc student, 2013-present

Department of Community Health & Epidemiology

Thesis: The association between maternal exposure to environmental chemicals and hypospadias

Dr. Linda Dodds, thesis supervisor

[JILLIAN CARTER](#) - MSc student, 2013-present

Department of Community Health & Epidemiology

Thesis: Children with central lines at the IWK: identifying risk factors and protection against mechanical and infectious complications

Dr. Stefan Kuhle, thesis committee member

[MARK STAPLES](#) - MASc student, 2012-present

Department of Industrial Engineering

Thesis: Modelling transition probabilities from population-based data using multinomial splines

Dr. Stefan Kuhle, thesis co-supervisor

[ABBEY POIRIER](#) - MSc student, 2012-present

Department of Community Health & Epidemiology

Thesis: The association between air pollution levels and gestational hypertension in urban Halifax

Dr. Linda Dodds, thesis supervisor

[MADONNA ACKKAR](#) - MSc student, 2011-present

School of Dietetics and Human Nutrition, McGill University, Montreal

Thesis: Vitamin D status in pregnant women from Eastern Canada: what levels protect against preeclampsia?

Dr. Linda Dodds, thesis committee member

[JILLIAN ASHLEY-MARTIN](#) - PhD candidate, 2010-present

Interdisciplinary Studies

Thesis: Characterizing health effects of joint exposures: assessing impact of prenatal exposure to multiple environmental chemicals on newborn immune system development

Dr. Linda Dodds, thesis co-supervisor

[CATHERINE MORGAN](#) - completed MSc November 2013

Department of Community Health & Epidemiology

Thesis: Cord blood vitamin D status and neonatal outcomes in a birth cohort in Quebec

Dr. Linda Dodds, thesis supervisor; Dr. Christy Woolcott, thesis committee member

[TARRA PENNEY](#) - completed MA September 2013

School of Health and Human Performance

Thesis: Understanding obesity-related health behaviour within the modern food environment

Dr. Stefan Kuhle, thesis committee member

[DR. AMY ORNSTEIN](#) - completed MSc July 2013

Department of Community Health & Epidemiology

Thesis: Delivering The Period of PURPLE Crying on the Family Newborn Unit: another step towards child abuse prevention

Dr. Linda Dodds, thesis supervisor; Christy Woolcott, thesis committee member

[VANESSA RYAN](#) - completed MSc November 2012

Department of Community Health & Epidemiology

Thesis: Can RSV-associated hospitalization in the first year of life be predicted at birth among infants born at 32-35 weeks gestation?

Dr. Linda Dodds, thesis committee member

[CATHERINE BROWN](#) - completed MSc August 2012

Department of Community Health & Epidemiology

Thesis: Rates and determinants of breastfeeding exclusivity and duration in Nova Scotia women

Dr. Linda Dodds, thesis supervisor

[LISA CURRIE](#) - completed MSc September 2011

Department of Community Health & Epidemiology

Thesis: Accuracy of two tools; Rourke Baby Record, Developmental Section, and the Nipissing District Developmental Screen (NDDS), for detecting developmental delay at eighteen months compared to the Bayley Scales of Infant and Toddler

Development III: a pilot study

Dr. Linda Dodds, thesis supervisor

[PRISCILLA FRENETTE](#) - completed MSc September 2010

Department of Community Health & Epidemiology

Thesis: Factors affecting the age at diagnosis of autism spectrum disorders in Nova Scotia

Dr. Linda Dodds, thesis supervisor

Medical students

[RACHEL DOUCETTE](#) - medical student summer research project, 2013

Departments of Obstetrics & Gynaecology and Pediatrics

Project: Barriers to childhood obesity management

Dr. Stefan Kuhle, supervisor

[KELLI FLEMMING](#) - medical student summer research project, 2012

Departments of Obstetrics & Gynaecology and Pediatrics

Project: Caesarean section and risk of obesity in the offspring

Dr. Stefan Kuhle, supervisor

[ALEX LEGGE](#) - medical student summer research project, 2012

Departments of Obstetrics & Gynaecology and Pediatrics

Project: Influenza vaccine during pregnancy: rates, determinants, and outcomes

Dr. Linda Dodds, supervisor

[PRISCILLA FRENETTE](#) - medical student summer research project, 2011

Department of Obstetrics & Gynaecology

Project: Pre-term, pre-labour rupture of membranes: effect of latency on neonatal and maternal outcomes

Dr. Linda Dodds, supervisor

[KAYLA SHEPPARD](#) - medical student summer research project, 2011

Department of Obstetrics & Gynaecology

Project: A pilot study of the associations among ghrelin, adipocytokines, glycemic control and adiposity-related perinatal outcomes

Dr. Christy Woolcott, co-supervisor

Residents and fellows

DR. ANNA COOLEN - resident

Department of Obstetrics & Gynaecology

Project: Elective repeat caesarean delivery: fetal lung maturity testing and neonatal respiratory morbidity

Dr. Linda Dodds, supervisor

DR. KAYLA FELDMAN - fellow

Neonatal Perinatal Medicine, Department of Pediatrics

Project: Neonatal outcomes in spontaneous versus obstetrically indicated late preterm births in a Nova Scotian population

Dr. Christy Woolcott, co-supervisor

DR. PAUL KAHLKE - resident

Department of Pediatrics

Project: Causes of infant mortality in previously-healthy infants in Nova Scotia 1992-2012

Dr. Linda Dodds, supervisor

DR. CHRIS NASH - resident

Department of Obstetrics & Gynaecology

Project: The accuracy of pre-natal ultrasound in estimating fetal birth weight at various gestational ages in diabetic women with singleton pregnancies

Dr. Christy Woolcott, co-supervisor

DR. MILA SMITHIES - resident

Department of Obstetrics & Gynaecology

Project: The prevalence of smoking among pregnant women in Nova Scotia from 1988 to 2009

Dr. Linda Dodds, supervisor

DR. MOHAMED TAGIN - fellow

Neonatal Perinatal Medicine, Department of Pediatrics

Project 1: Long-term outcomes of singletons and twins < 31 weeks at birth: a population-based study

Project 2: Hypothermia for neonatal hypoxic ischemic encephalopathy: an updated systematic review and meta-analysis

Dr. Christy Woolcott, co-supervisor

DR. KIM MACDONALD - resident

Department of Obstetrics & Gynaecology

Project: SMA carrier testing: an analysis of differences in test performance by ethnic group

Dr. Stefan Kuhle, supervisor

DR. JESSICA YEATES - resident

Department of Pediatrics

Project: Determinants of physical activity and a healthy diet in Grade 7-9 Nova Scotian junior high school students

Dr. Stefan Kuhle, supervisor

DR. LAURA SWANEY - resident

Department of Pediatrics

Project: Evaluation of a family-centered camp with focus on behavioural and lifestyle modifications for the treatment of childhood obesity

Dr. Stefan Kuhle, co-supervisor

PERU TRAINEE PRESENTATIONS AND AWARDS 2010-2013

CATHERINE MORGAN - MSc student

Cord blood serum vitamin D status and neonatal outcomes in a Canadian birth cohort

Presented at the Canadian Society for Epidemiology and Biostatistics Student Conference, June 2013

ABBEY POIRIER - MSc student

The association between air pollution levels and gestational hypertension in urban Halifax

Presented at the Canadian Society for Epidemiology and Biostatistics Student Conference, June 2013

JILLIAN ASHLEY-MARTIN - PhD student

Gestational weight gain and postpartum weight retention in a cohort of Nova Scotian women

Presented at Department of Obstetrics & Gynaecology 27th Annual Trainee Research Day, April 2013, 1st place graduate student presentation

ALEX LEGGE - medical student

Influenza vaccine during pregnancy: rates, determinants and outcomes

Presented at Undergraduate Student Health Research Day, Dalhousie University, November, 2012, 1st place oral presentation

Presented at Department of Pediatrics Research Day, April 2013

Presented at Department of Obstetrics & Gynaecology Research Day, April 2013

Presented at the annual meeting of the Society of Obstetricians and Gynaecologists of Canada, Calgary, June, 2013, runner-up, oral presentations by medical students

KELLI FLEMMING - medical student

The association between caesarean section and childhood obesity revisited

Presented at Department of Pediatrics Research Day, April 2013, 1st place medical student category

Presented at Interprofessional and Undergraduate Student Health Research Day, Dalhousie University, November 2012, 1st place for poster presentation

KAYLA FELDMAN - Neonatal Perinatal Medicine fellow

Late preterm birth: indications for delivery and neonatal outcomes in a Nova Scotian population

Presented at Canadian Paediatric Society 89th Annual Conference, London ON, June 2012 [Abstract published in Paediatrics & Child Health, 17 (Suppl A):35A, 2012]

Pediatric Academic Societies Annual Meeting, Boston, May 2012

MILA SMITHIES - Obstetrics & Gynaecology resident

The prevalence of smoking among pregnant women in Nova Scotia from 1988 to 2009

Presented at Department of Obstetrics & Gynaecology Research Day, April 2012, 2nd place resident category

Presented at Atlantic Society of Obstetricians and Gynecologists, St. John's, Newfoundland, October 2012

Best Research Award for a Resident (PGY 3 or 4) who has incorporated research into their primary training program. The award is sponsored by the Dalhousie Medical Research Foundation (DMRF) 2013.

CATHERINE BROWN - MSc student

Exploring the gap between breastfeeding practices and recommendations: rates and determinants of exclusive breastfeeding to six months in Nova Scotia mothers

Presented at Department of Obstetrics & Gynaecology Research Day, April 2012, 1st place Graduate Student category

Presented at Department of Pediatrics Research Day, April 2012

Presented to Public Health, Cape Breton District Health Authority, April 2012

Presented to Public Health, Guysborough Antigonish Strait Health Authority, April 2012

Presented to Nova Scotia Breastfeeding Committee of the Department of Health and Wellness, May 2012

MOHAMED TAGIN - Neonatal Perinatal Medicine fellow

Hypothermia for neonatal hypoxic-ischemic encephalopathy: an updated systematic review and meta-analysis

Presented at Pediatric Academic Societies Annual Meeting, Boston, April 2012

Long-term outcomes of singletons and twins < 31 weeks at birth: a population-based study

Presented at Pediatric Academic Society, Denver, May 2011

Department of Pediatrics Research Day, April 2011

PRISCILLA FRENETTE - MSc student and medical student

Factors affecting the age at diagnosis of autism spectrum disorders in Nova Scotia

Presented at Department of Pediatrics Research Day, April 2011

Reproductive stoppage in families with a child with autism

Presented at Department of Obstetrics & Gynaecology Research Day, April 2011

Preterm prelabour rupture of membranes: effect of latency on neonatal and maternal outcomes

Presented at Interprofessional Health Research Day, Dalhousie University, November 2011, 1st place poster presentation

Presented at the annual meeting of the Society of Obstetricians and Gynaecologists of Canada, Ottawa, June, 2012, 1st place medical student poster award

ANNA COOLEN - Obstetrics & Gynaecology resident

Elective repeat caesarean delivery: fetal lung maturity testing and neonatal respiratory morbidity

Presented at Department of Obstetrics & Gynaecology Research Day, April 2011, 2nd place resident category

Presented at the annual meeting of the Society of Obstetricians and Gynaecologists of Canada, Vancouver June 2011

Presented at Atlantic Society of Obstetricians and Gynecologists, Charlottetown, October 2011

LISA CURRIE - MSc student

Accuracy of two tools; Rourke Baby Record, Developmental Section, and the Nipissing District Developmental Screen, for detecting developmental delay at thirty-six months compared to the Bayley Scales of Infant and Toddler Development III: a pilot study

Presented at Department of Pediatrics Research Day, April 2011

Physical activity during pregnancy and fetal growth

Presented at the Society for Pediatric and Perinatal Epidemiologic Research, Montreal, June 2011

Physical activity and pregnancy outcomes

Presented at North American Congress of Epidemiology, Montreal, June, 2011

Presented at Department of Obstetrics & Gynaecology Trainee Research Day, April 2013

KAYLA SHEPPARD - medical student

A pilot study of the associations among ghrelin, adipocytokines, glycemic control and adiposity-related perinatal outcomes.

Presented at IHRTP Health Trainee Research Day, Halifax, November 2011

PERU TRAINEE FUNDING AWARDS 2010-2013

RACHEL DOUCETTE

CIHR Health Professional Student Research Award, 2013

ABBEY POIRIER

Graduate Student Scholar Award, Master Level, Nova Scotia Health Research Foundation, 2013-2014

IWK Graduate Student Scholarship, 2013-2014

JILLIAN ASHLEY MARTIN

Scotia Scholar Award, PhD Level, Nova Scotia Health Research Foundation, 2012-2014

Category A grant, IWK Health Centre, 2012-2014

KELLI FLEMMING

Faculty of Medicine Beth Rafuse Summer Medical Student Research Award, Dalhousie Medical Research Foundation, 2012

ALEX LEGGE

Faculty of Medicine Dr. Carl Tupper Summer Medical Student Research Award, Dalhousie Medical Research Foundation, 2012

PRISCILLA FRENETTE

Faculty of Medicine Beth Rafuse Summer Medical Student Research Award, Dalhousie Medical Research Foundation, 2011

CATHERINE BROWN

Graduate Student Scholar Award, Master Level, Nova Scotia Health Research Foundation, 2011-2012

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