Ontario Asthma Surveillance Information System (OASIS): 10th Anniversary Report

Dr. Teresa To and Team
THE HOSPITAL FOR SICK CHILDREN
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This past year OASIS turned 10. It seems like just yesterday that OASIS was born, but in fact it has been a decade! Although I am shocked about how fast time has gone by, I am extremely proud of how much OASIS has matured over the past 10 years. It has been quite a journey, which I am excited to share with you!

Ten years ago we treaded into unknown territory. We started with only a case definition of asthma and an ambitious vision to create a population-based database. Today, the OASIS database has matured into an entity that has been recognized as a prototype for population surveillance. Data has been assembled from 1996 to current, and the database follows over 2 million Ontarians with asthma, reporting their health status and outcomes annually.

The OASIS team is grateful for the significant contributions that many individuals have made to our work. We have met and collaborated with many amazing individuals throughout this journey, including researchers, clinicians, students, trainees, stakeholders, patients and families. In this report, we will share with you the details of this journey, the multitude of milestones that OASIS has reached, and our ambitious plan for the next 10 years.

It has been an honour to lead OASIS over the past 10 years and I look forward to the next 10!

Sincerely,

Teresa To

Teresa To, MSc, PhD
Director, Ontario Asthma Surveillance Information System
Senior Scientist, The Hospital for Sick Children
Professor, Dalla Lana School of Public Health, University of Toronto
From the Beginning

In January, 2000, Joshua Fluelling, an 18 year-old who lived in Toronto, died from a severe asthma attack on his way to the emergency room. This death shocked those in the medical community – raising questions about how this could happen, given that asthma is a relatively controllable condition. The resulting inquest identified a number of recommendations to address gaps in knowledge and improve services for people with asthma throughout the province.

As part of the inquest, the Ontario Ministry of Health and Long-term Care (MOHLTC) assembled a Steering Committee consisting of a panel of experts to provide recommendations to the Provincial Government. In January 2002, the Ontario Government announced $4 million of annual funding to implement a comprehensive plan with the ultimate goal of improving the treatment and control of asthma. This plan is called the Asthma Plan of Action (APA). The APA is committed to providing support to people with asthma and their families, as well as helping health care providers and researchers to provide the best diagnosis, education and care possible.

The $4 million annual funding supports an integrative plan consisting of 13 initiatives aimed at reducing mortality, morbidity and costs from asthma. These 13 initiatives fall into the following themes: health promotion and prevention; management and treatment; and research and surveillance. OASIS was the outcome of the “Asthma Surveillance” initiative (Figure 1).

Establishing the Cohort

The first necessary task for OASIS was to establish an asthma cohort. This required defining asthma for surveillance. An asthma case definition was developed, defining individuals as asthma cases if they had one asthma hospital admission or two asthma physician visits within two years. This case definition was first verified through a chart abstraction study in the paediatric population. The administrative diagnosis code for asthma was found to be sensitive and specific for identifying children with asthma.1 Next, we established Canada’s first longitudinal surveillance program to examine the burden of asthma on Ontario’s children and on the provincial health care system.2 After successfully creating the paediatric cohort, the asthma surveillance system was expanded to include data of individuals aged 0-39. A report of the burden of asthma in this larger cohort was published.3 In 2008, the OASIS database was extended to include individuals over 40 years of age.

Figure 1. Initiatives of the Asthma Plan of Action

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Data Used for the Cohort

The OASIS cohort was built using Canadian Institute for Health Information (CIHI) discharge abstracts, emergency room data from the National Ambulatory Care Reporting System (NACRS) and Ontario Health Insurance Plan (OHIP) billings from 1991 to 2012. Data from years 1991 – 1995 were first used to establish asthma incidence, and health service use and yearly updates start from 1996. The OASIS cohort includes all individuals aged 0 to 99 with asthma who reside in Ontario. Currently, there are over 2 million individuals followed by OASIS.

Influencing Asthma Care in Ontario

Developing and Using Performance Indicators

Once the asthma cohort was developed, the OASIS team focused on developing a list of asthma performance indicators for use in the primary care setting. An extensive systematic literature review was completed with the following question in mind: “What current community and primary care asthma performance indicators are there that focus on physician behaviour and patient characteristics?”

Particular attention was focused on access to primary care, clinical effectiveness, patient centeredness, service integration and safety. A list of 45 indicators was generated and ranked using a Delphi survey and a face-to-face expert panel discussion. Based on these rankings, the list was narrowed to 15 indicators. The process for identifying these top 15 indicators was published in 2010.4

Later in 2010, the OASIS team organized and arranged the 15 indicators into 9 categories to form the Primary Care - Asthma Performance Indicators (PC-API) form. This form was developed for use in primary care settings to measure asthma care and health outcomes and identify areas for improvement. A pilot study was conducted to test the PC-API’s feasibility in clinical practice. This study found the PC-API to be feasible and easy to use in the primary care setting.5

In 2012, the PC-API form was transferred to the REDCap (Research Electronic Database Capture) database and a number of primary care sites in Ontario were given the opportunity to record and track their use of asthma performance indicators. Currently, 11 primary care sites are entering data, and a total of 382 visits have been entered. Participating sites receive quarterly

“OASIS data has provided valuable epidemiologic information regarding outcomes of individuals with asthma and a variety of indicators of asthma performance - such as the use of spirometry for asthma diagnosis and monitoring.”

- Dr. Diane Lougheed, Clinician-Scientist

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reports of their use of the indicators as captured by PC-API. The first report was generated in June 2013, and reports have been generated quarterly since then.

In 2013, the OASIS team also tested the possibility of auto-populating the PC-API using the Asthma Research Group Inc (ARGI) electronic medical record data and found auto-population of the form feasible. Moving forward, we will continue to explore options for auto-populating the PC-API using electronic data at primary care sites.

Moving towards a national strategy

In April 2013, the OASIS team held a Canada Institutes for Health Research (CIHR) funded workshop titled, “Developing a National Strategy to Implement and Evaluate Evidence-Based Indicators”. Attendees included 30 participants, representing a cross-section of researchers, clinicians and stakeholders from across Canada. The aim of this workshop was to solicit input from these experts for moving forward with implementing asthma performance indicators across Canada. A project proposal was developed using the knowledge obtained from this meeting. This proposal will be submitted to the CIHR - Partnerships for Health System Improvement (PHSI) grant competition in the fall of 2014.

“The Ontario Lung Association relies on the excellent data resources provided by OASIS in many aspects of its work - the Provider Education Program, the Primary Care Asthma Program and our Public Education and Government Relations initiatives, to name a few...

We will continue to use the excellent OASIS resource in all areas of work. We will deploy newly updated OASIS data to ensure that our messaging and communication about asthma is up-to-date. OASIS information is essential in determining which areas are improving and which need improvement.”

- Andrea Stevens Lavigne, Vice-President, Provincial Programs, Ontario Lung Association

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Current OASIS Research team. Top row, from left: Chenwei Gao (Biostatistician Analyst), Jingqin Zhu (Biostatistician), Jacqueline Simatovic (Project Manager), Andrea Verdugo (Senior Secretary). Bottom row, from left: Devon Williams (Research Assistant), Richard Foty (Research Student), Dr. Teresa To (Senior Scientist), Laura Feldman (Research Student), Dr. Andrea Gershon (Physician-Scientist).
10 Years of OASIS

Institute for Clinical Evaluative Sciences (ICES) Report: Burden of Childhood Asthma

Asthma Plan of Action (APA) meeting: What about asthma indicators?

Occupational Asthma Surveillance System (OCAS) project launched

2004

Surveillance system fully operational

OCAS Phase 2 initiated – Ontario Work-Related Asthma Surveillance (OWRAS)

ICES Report: Burden of asthma in Ontario

2006

OASIS aggregated data/reports made available on inTool website

Respiratory Population-based Outcomes Network: Studies and Evaluations (RESPONSE) project launched. Allowed for establishment of evidence-based indicators to measure asthma quality of care and outcomes

2008

Dr. To 6 month sabbatical:
Represented OASIS at 1) Australian Centre for Asthma Monitoring, University of Sydney and 2) Global Alliance against chronic Respiratory Disease (GARD) at the World Health Organization, Geneva

2003

Childhood asthma case definition verification study

Birth of OASIS

Primary Care Asthma Program Pilot (PCAPP) launched

2005

ICES inTool: asthma website created

Adult asthma case definition verification study

2007

Dr. To 6 month sabbatical:
Represented OASIS at 1) Australian Centre for Asthma Monitoring, University of Sydney and 2) Global Alliance against chronic Respiratory Disease (GARD) at the World Health Organization, Geneva
2009

Forecasts of burden of asthma in 2020

15 asthma indicators identified and recommended for implementation

Asthma indicator feasibility studies planned and implemented

2010

Database extended to include individuals over the age of 40

Primary Care Asthma Performance Indicators (PC-API) launched. Collecting primary care providers use of performance indicators

2011

Developed health administrative data definition of severe asthma

Evidence based performance indicators populated using OASIS data. Results stratified by physician models and Local Health Integration Networks (LHI�)

2012

Asthma Plan of Action (APA) meeting: What about asthma indicators?

Occupational Asthma Surveillance System (OCAS) project launched

ICES inTool: asthma website created

Adult asthma case definition verification study

Surveillance system fully operational

OCAS Phase 2 - initiated – Ontario Work-Related Asthma Surveillance (OWRAS)

ICES Report: Burden of asthma in Ontario

OASIS aggregated data/reports made available on inTool website

Respiratory Population-based Outcomes Network: Studies and Evaluations (RESPONSE) project launched. Allowed for establishment of evidence-based indicators to measure asthma quality of care and outcomes

2013

Partnership to use the Ontario subset of the Canadian National Breast Screening Study (CNBSS) and OASIS data to examine the relationship between baseline risk factors and asthma among a longitudinal cohort of women

Forecasts of burden of asthma in 2020

15 asthma indicators identified and recommended for implementation

Asthma indicator feasibility studies planned and implemented

Asthma Performance Indicators National Strategies meeting

First PC-API reports sent to participating sites

Contract established with Health Canada to examine the relationship between environmental exposures and asthma surveillance measures

Dr. To leading a platform of the Canadian Respiratory Research Network (CRRN)

Dr. To 6 month sabbatical: Represented OASIS at 1) Australian Centre for Asthma Monitoring, University of Sydney and 2) Global Alliance against chronic Respiratory Disease (GARD) at the World Health Organization, Geneva
Impact, Knowledge Translation and Partnerships

Over the past 10 years, OASIS has had an impact in 3 major ways:

1. Providing a population-based surveillance system to monitor asthma morbidity and mortality
2. Providing access to indicators to measure quality of care (i.e. PC-API)
3. Providing learning opportunities and a training ground for students and trainees

In the first few years of OASIS, the team focused on establishing the database and creating incidence and prevalence reports. After the database was developed and regular reports were being produced, the focus shifted towards establishing partnerships and collaborations with researchers and decision makers interested in using the OASIS database.

One of the first collaboration was with the Ministry of the Environment (MoE). This collaboration allowed the OASIS team to access air quality data, and to correlate this data with OASIS data to study the impact of pollution on those living with asthma. This compilation of data led to a collaboration with the CIHR funded Canadian Respiratory Research Network. The OASIS team members were invited to be part of the network and to lead one of the major platforms of the network – to examine the cumulative effects of environmental exposure on the progression of asthma to COPD (described below). Further, Dr. To was invited to join the newly established Health Canada Air Quality Health Index (AQHI) Health Research Working Group. Representatives from various jurisdictions have indicated interest in collaborating with OASIS to compare AQHI and reported asthma findings. Through partnership with Public Health Ontario (PHO), arrangements were made with Health Canada to obtain daily temperature and humidity data to further examine the independent and synergistic effective of extreme temperatures on people living with asthma and asthma-related conditions.

Other collaborating organizations include Health Canada, the Ontario Lung Association (OLA), Canadian Thoracic Society, the Public Health Agency of Canada (PHAC), AllerGen NEC Inc., and health care groups such as Local Health Integration Networks (LHINs), Primary Care Asthma Program and many individual primary care practices.

OASIS has also established partnerships worldwide. In 2007, Dr. To, representing OASIS, took a 6-month sabbatical to collaborate and exchange research expertise with two overseas organizations: 1) the Australian Centre for Asthma Monitoring (ACAM) at the Woolcock Institute of Research, University of Sydney; and 2) the Global Alliance against Chronic Respiratory Diseases (GARD) at the World Health Organization (WHO) in Geneva. During this time, research collaborations were established with the ACAM and international partnerships were developed with various countries who are members of GARD-
WHO. Representing OASIS, Dr. To formally joined GARD-WHO as a member of the alliance in 2008, was elected the GARD electoral officer in 2009, and has been a member of the GARD Planning Committee since 2011. The research collaboration and global partnerships help with the transfer of tools developed by the OASIS team worldwide.

**Current Collaborations with OASIS**

**WEB-BASED ASTHMA CONTROL APP**
This project, titled “Consumer Access to Personal Health Information for Asthma Self-Management” (i.e. breathe App), aims to measure the utility of a web-based application for improving and maintaining control of asthma. It involves comparing the health outcomes of patients receiving access to a Smart phone and/or web-based asthma action plan application (breathe), patients receiving standard care within an asthma program, with demographically matched nonparticipant controls. Data for the matched nonparticipant controls will come from the OASIS database. This project involves collaboration with researchers at Western University and Queen's University, and is funded by the Ontario Lung Association (OLA) through a grant from Canada Health Infoway Consumer Health Solution Demonstration Project. The OASIS team is leading the matched case-control evaluation for this project.

**CANADIAN NATIONAL BREAST SCREENING STUDY**
An agreement was established with the Canadian National Breast Screening Study (CNBSS) to link their Ontario subset to ICES data (n~30,000). The women in the CNBSS study have been followed from the early 1980s to current for their mortality status. Their morbidity data was collected, but never studied. The OASIS team has been given the opportunity to use this data and link to the OASIS database. Linking the CNBSS data to OASIS, will provide estimates of asthma and asthma-related risks in association with baseline risk factors such as smoking, diet, BMI, family history – information that was not previously available. Further, with the use of postal codes, the OASIS team will be able to link health outcomes to environmental exposure data. With over 30 years of follow-up data from this cohort, cumulative environmental exposures could be calculated and correlated to health outcomes. This project is funded by Health Canada.

**ENVIRONMENTAL EXPOSURE AND CLIMATE CHANGE ON THE PROGRESSION OF ASTHMA TO COPD**
Dr. To and the OASIS team have also been invited to be part of the Canadian Respiratory Research Network (CRRN), funded by the Canadian Institutes of Health Research, Institute of Circulatory and Respiratory Health Emerging Network funding opportunity. Dr. To and the OASIS team will lead a platform of the CRRN, and will use OASIS data to determine the effects of different air pollutants and climate mixtures on the development, exacerbations and progression of asthma and COPD. Exposure to air pollution has been shown to increase mortality and morbidity risks among those with COPD and asthma. This study will use the OASIS database to measure the relationship of air pollution and climate change to the progression of disease, and identify locations and population groups at greatest risk for specific respiratory health threats during smog days and extreme heat/cold waves. It will further identify if there are subgroups of the population (age, sex, rural/urban living, SES, smoking and other factors) that are more susceptible to adverse respiratory health effects of air pollution and climate change. This study will inform decision makers, health care providers and the public of the risks of environmental exposure to those with asthma and COPD.
More than Meets the Eye

The utility of OASIS extends much further than the statistics and surveillance information it provides to facilitate improvement of asthma care. It is also an essential training ground for students and fellows. The following are trainees (listed in alphabetical order who have benefited from OASIS.

**Current Trainees**

Laura Feldman *(Master’s Student starting Fall 2014; Undergraduate Student, 2011 – 2014).* Studying spatial distribution of asthma mortality and morbidity.

Richard Foty *(Doctoral Student, 2011 – present).* Studying correlations of air quality and health outcomes, including asthma and COPD.

Jessica Omand *(Doctoral Student, 2013 – present).* Studying the association of Vitamin D, respiratory tract infections and asthma by linking data from TARGet Kids! (pediatric community centres in Greater Toronto Area) with OASIS.

Elinor Simons *(Doctoral Student, 2009 – present).* Exploring associations between atopy and asthma with home and school exposures to airborne pollutants and allergens.

**Past Trainees**

Sharon Dell *(Post-Doc Research Fellow, 1999 – 2003).* Dr. Dell was a fellow with Dr. To at the time OASIS was born. She was involved in the chart abstraction study that generated data to establish the childhood asthma definition to be used in OASIS. Dr. Dell has since been appointed Senior Associate Scientist at SickKids, and Director of the Clinical Epidemiology Program at the University of Toronto.

Eileen Estrabillo *(Practicum Student, 2005 – 2006).* Participated in generating asthma surveillance statistics. She has since completed her MSc at the University of Toronto and a MD degree at the University of Alberta.

Andrea Gershon *(Post-Doc Research Fellow, 2006 – 2009).* Focused on linking public and health administrative databases, and broadening infection disease surveillance in Ontario. Dr. Gershon has since established a COPD database and is now an appointed scientist at ICES and is leading the ICES Lung Health Research Theme Group.

Patricia Li *(Post-Doc Research Fellow, 2010 – 2012).* Studied the association of time to follow-up after an emergency department visit for asthma with subsequent healthcare utilization. Dr. Li is currently a
Cindy Shen (Practicum Student, 2011). Examined correlations between air pollutants and asthma morbidity outcomes. She is currently a medical student at the University of Toronto.

Dhenuka Radhakrishnan (Master’s Student, 2006 – 2013). Using data from OASIS, Dr. Radhakrishnan constructed multiple birth cohorts to study the trends in age and severity at asthma diagnosis for Ontario children over time. Dr. Radhakrishnan is now a staff pediatric respirologist at the London Health Science Centre, an Associate Scientist at the Lawson Research Institute and a member of the ICES@Western Faculty Scholar Program.

Chengning Wang (Master’s Student, 2003 – 2006). Studied the relationship of socioeconomic status and health outcomes. Dr. Wang is currently a paediatric resident at the Hospital for Sick Children.

“I benefited from using the OASIS database to conduct my master’s thesis, and I continue to use this database and collaborate with the OASIS team.”
- Dhenuka Radhakrishnan

“Working on the OASIS project has helped me truly understand the burden of the disease on the population level... this understanding has made me more aware of the challenges we as healthcare providers are facing when caring for children and adults with asthma.”
- Chengning Wang

“I have used OASIS data for two of my PhD thesis projects. These studies have been my first experience working with administrative data and it has been extremely helpful to have a validated database that allowed me to accurately identify Ontario children with asthma and to follow their healthcare visits and diagnosis over time.”
- Elinor Simons

Summer Students

Rachel Feldman. Currently a medical student at University of Calgary.

Ginette Moores. Currently a medical student at McMaster University.

Preethy Prasad. Currently a PhD student at the University of Toronto.

Gina Schwamborn. Currently a RN at St. Joseph’s Health Centre, Toronto.
Future Directions

OASIS has come far in 10 years - from the development of the OASIS database to partnerships, knowledge translation, and network integration. OASIS lays the foundation for researchers to identify barriers to optimal disease management, examine risk factors and quantify the burden of co-morbidities. Future endeavours of OASIS will continue to translate knowledge into usable forms for primary care providers and other stakeholder.

It is expected that the population-based assessments of asthma health made possible by surveillance will serve as a benchmark to monitor future changes in diagnoses, treatment, management and health services use in asthma. As described earlier, the OASIS team has gathered researchers, clinicians and stakeholders from across the country and created a proposal aiming to improve quality of asthma care in Canada. One goal of this project is to make asthma performance indicators more accessible to primary care providers through the use of a web-based application available on a tablet called the “indicators for COPD and Asthma Performance” (iCAP). This project has the potential to have an impact at the patient level through improved patient outcomes, provider level through engagement and empowerment to improve their quality of care, and policy level through an understanding of quality of care at the provincial and national level.

The OASIS team sees great opportunity with current and future partnerships with outside sources, and has already formed partnerships with Health Canada, the Canadian Respiratory Research Network, and Ministry of the Environment. The team has also been experiencing increasing interest from outside sources to use the OASIS data to help them reach their goals or objectives. In the next 10 years, the OASIS team will continue to focus on developing partnerships and collaborations, as well as bringing OASIS to the community.
Acknowledgments

OASIS could not have been possible without the support from a number of individuals and organizations. First, we thank the Ministry of Health and Long-Term Care (MOHLTC) for funding OASIS, as well as the Public Health Agency of Canada (PHAC) for funding the validation of an asthma case definition for population surveillance. Without this financial support, our endeavours would not have been possible and OASIS would not exist.

We would also like to thank the Institute for Clinical Evaluative Sciences (ICES) for granting us access to and use of Ontario health administrative data to create and maintain the OASIS database. Thank you to the Research Institute at the Hospital for Sick Children for providing us the research space – a home for our work, and a supportive and inspiring work environment for our OASIS team. We would also like to thank all of the current and past trainees and OASIS staff who contributed their time and energy to these projects. Only through a great team effort has OASIS become the entity that it is. Last but not least, we owe tribute to Ms. Nancy Garvey, Senior Consultant at MOHLTC, who has provided valuable input and guidance throughout this journey.

Thank you.