A Breath of Fresh Air / Une bouffée d'air frais

Abstracts from the 2011 Canadian Respiratory Conference
Résumés du Congrès canadien sur la santé respiratoire 2011

April 28–30, 2011
Niagara Falls, Ontario

The present online supplement highlights the poster abstracts selected for presentation at the 4th Annual Canadian Respiratory Conference (CRC) held in Niagara Falls, Ontario, in April 2011. The CRC is a partnership initiative of the Canadian Thoracic Society, Canadian Respiratory Health Professionals, The Lung Association and the Canadian COPD Alliance, and has become the premiere national educational and scientific meeting for the respiratory community in Canada. I would like to acknowledge the leadership and expertise of the Scientific Committee, our conference speakers and abstract presenters, all of whom contributed to the delivery of an excellent program. The next Canadian Respiratory Conference will be held in Vancouver, British Columbia, April 26 to 28, 2012 (www.lung.ca/crc). We look forward to seeing you there.

Rob McFadden, Chair
Canadian Respiratory Conference Scientific Committee

Le présent cybersupplément fait ressortir les résumés par affiche sélectionnés en vue d'être présentés au 4e Congrès canadien sur la santé respiratoire (CCSR) annuel, qui s'est déroulé à Niagara Falls (Ontario) en avril 2011. Le CCSR, un partenariat entre la Société canadienne de thoracologie, les Professionnels canadiens en santé respiratoire, L'Association pulmonaire et l'Alliance canadienne sur la MPOC, est devenu le principal congrès scientifique et de formation national pour la communauté des soins respiratoires au Canada. Je tiens à souligner le leadership et les compétences du comité scientifique, des conférenciers et des présentateurs de résumés, qui ont tous contribué à l'excellence du programme. Le prochain Congrès canadien sur la santé respiratoire aura lieu à Vancouver (Colombie-Britannique) du 26 au 28 avril 2012 (www.poumon.ca/crc). Nous avons hâte de vous y rencontrer.

Rob McFadden, président,
Comité scientifique du Congrès canadien sur la santé respiratoire

Stream 1: Basic Research / Séance 1: Recherche fondamentale

Stream 2: Epidemiology of Lung Diseases / Séance 2: Épidémiologie de maladies pulmonaires

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Stream 8: Pediatrics / Séance 8: Pédiatrie

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General Poster Display (Non-Moderated) / Le Séance génerale de presentation d'affiches (sans modérateur)

Scientific Poster Abstracts / Les abrégés d'affiches scientifiques / By Presenting Author's Last Name / Par le nom de famille de l'auteur présentateur

ROLE OF SPLEEN TYROSINE KINASE (SYK) IN ALLERGEN-INDUCED AIRWAY HYPERRESPONSIVENESS IN A CHRONIC MURINE MODEL OF ASTHMA

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RATIONALE: Spleen tyrosine kinase (Syk) plays an important role in the pathogenesis of asthma.
OBJECTIVE: To evaluate the role of Syk in an allergen-induced airway inflammation and airway hyperresponsiveness (AHR) in a chronic murine model of asthma.
METHODS: Female BALB/c mice were sensitized by intraperitonial injection to ovalbumin on days 0 and 7. OVA-sensitized mice were then randomly challenged to 2.5% nebulised OVA (OVA/OVA) or PBS (OVA/PBS) on two consecutive days every two weeks until week 12. We evaluated physiologic responses using FlexiVent system (Scireq Inc. Montreal QC) to measure airway resistance, total lung volume and compliance, and methacholine (MCh) responsiveness. Lung tissue homogenates were analyzed with protein biochemistry to determine changes in Syk expression between control and experimental groups. Lungs were harvested for histological determination of leukocyte recruitment and Syk localization. The role of Syk was evaluated by using a Syk selective inhibitor, NVP-QAB-205, which has been well-defined pharmacologically.
RESULTS: Syk expression is localized to the airway epithelium of the lung and inflammatory cells. Expression of Syk is increased in OVA-sensitized and OVA-challenged (OVA/OVA) mice when compared with control (OVA/PBS). The augmentation of Syk expression corresponds with the increase in the responsiveness to MCh in OVA/OVA mice. Intratracheal administration of nebulized Syk inhibitor NVP-QAB-205 was effective at abrogating the augmented airways responsiveness to MCh in the chronic OVA-sensitized and -challenged (OVA/OVA) mice without affecting the underlying pulmonary function or MCh-responsiveness in the control OVA-sensitized and PBS-challenged (OVA/PBS) mice.
CONCLUSION: Syk plays a functional role in the development of AHR and airway inflammation in a murine chronic model of asthma. Thus Syk inhibition may be an important therapeutic target for the treatment of asthma.
Supported by: *GlaxoSmithKline Collaborative Innovative Research Fund*

SYK MEDIATES AIR POLLUTION-INDUCED AIRWAYS HYPERRESPONSIVENESS

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RATIONALE: The spleen tyrosine kinase (Syk) is a key immunoregulatory signaling mediator in airway epithelial cells. Exposure to air-borne particulate matter (PM) is associated with exacerbations of asthma. Syk has recently been implicated in airways inflammation and hyper-responsiveness in a murine model of asthma. The role of Syk in air pollution-related immunopathology has not been studied to date. Our recent *in vitro* studies have shown that exposure of airway epithelial cells to PM induced activation of Syk, resulting in Syk-dependent phosphorylation of Jnk and Akt and production of VEGF and IL-8. PM also triggered a positive Syk-dependent paracrine effect on proliferation of human bronchial smooth muscle cells. In the present study, we investigated the role of Syk in the PM-induced effects on inflammatory changes and airways hyperresponsiveness *in vivo*.
METHODS: Syk was conditionally knocked-out in $Syk^{fl/fl}$// CreRosa26ERT2 mice by gavage with tamoxifen (20 mg/kg in sunflower oil vehicle; Sfo), on days 1-5, 15-19. On day 29 conscious animals, restrained in a nose-only exposure system, were exposed to PM (200-300 $\mu g/m^3$) for 4 hours using the Harvard Ambient Particle Concentrator. Pulmonary responses to methacholine (MCh) were assessed using the flexiVent. Tissues were collected for Western blotting, histology, immunohistochemistry, and bronchoalveolar lavage for cell counts.
RESULTS: Treatment with tamoxifen resulted in complete knockdown of Syk in $Syk^{fl/fl}$//CreRosa26ERT2 mice, as confirmed by Western blotting and confocal imaging of lung sections. *In vivo* exposure to PM induced airways hyperresponsiveness to MCh in Sfo treated animals, which was attenuated in the Syk knockdown mice ($p<0.0001$, n=15/group).
CONCLUSIONS: *In vivo* knockdown of Syk prevented PM-induced exacerbation of airway responsiveness to MCh. Thus, Syk could play a functional role in the effects of air pollution on airway epithelial cell activation and function, and may be a potential therapeutic target for better management of respiratory symptoms in susceptible populations.
Financial Support: *CIHR, Boehringer Ingelheim, Germany*

GENE EXPRESSION PROFILES DISTINGUISH USUAL INTERSTITIAL PNEUMONIA FROM NON-SPECIFIC INTERSTITIAL PNEUMONIA

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RATIONALE: Usual Interstitial Pneumonia (UIP) and Non-Specific Interstitial Pneumonia (NSIP) are among the most common forms of interstitial lung disease (ILD). The clinical/radiographic distinction may be challenging. Although better prognosis and response to therapy have been reported for NSIP compared to UIP, both conditions still represent a common indication for Lung Transplantation (LTx).
METHODS: Among 116 ILD patients who underwent LTx between 2001 and 2008, RNA was extracted and hybridized to the Human Gene 1.0 set array (Affymetrix) from explanted lungs in 26 patients with confirmed histological diagnosis and typical CT features of UIP, and from 13 subjects with confirmed histological pattern of NSIP in the native lungs. Cases with mixed UIP/NSIP or different patterns, and UIP cases with atypical radiographic features were excluded. Microarray analysis included Significance analysis of Microarray (SAM) and Ingenuity Pathway Analysis. Differentially expressed genes were identified based on a fold change ≥1.5 and a q value (false discovery ratio) <0.05.
RESULTS: NSIP patients were significantly younger ($p<0.001$) than UIP subjects. No significant differences in pulmonary function tests, exercise capacity or pulmonary artery pressures were observed. Distinct gene signatures were found. SAM, Network, Function and Pathway analysis showed that the genes with increased expression in UIP were involved in epithelial injury, cell death, tissue fibrogenesis and abnormal remodelling (Insulin-Like Growth Factor Binding Protein 5, MMP1, MMP7, MMP13, Osteopontin, Keratin 6C, 17, 19, 23). NSIP was characterized by genes involved in inflammatory response, chemotaxys, innate immunity and Interferon signaling (Heme oxygenase 1, PTX3, Endocan, Surfactant Protein D, Complement Component 5).
CONCLUSIONS: Genome-wide gene expression profiles clearly distinguish UIP from NSIP and point to a different pathogenesis, namely epithelial-driven fibroblast proliferation in UIP and alveolitis evolving to a fibrotic response in NSIP. Gene signatures could potentially be used to differentiate NSIP from UIP.
Financial Support*: Roche Multi Organ Transplant Academic Enrichment Fund; Lawson Scholarship*

THE USE OF LAMBS CHESTS IN CHEST DRAIN INSERTION SIMULATION

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RATIONALE: In an attempt to familiarize medical trainees with chest drain insertion, we sought to find a successful way of instructing students with its insertion technique.

METHODS: Students were given a thirty-minute lecture on chest anatomy, indications for insertion and then the insertion was demonstrated. Students were then taught the Seldinger (tube over guide-wire) technique and also the surgical drain (directly-visualized) insertion technique in a one-hour lab session. No direct comparison was made between other popular simulation mediums (such as plastic models or pork back ribs) nor then were students subsequently directly observed inserting tubes on actual patients.

RESULTS: The students were instructed then monitored and scored on successful insertion in the pleural space by an examiner informally. In discussion it was felt that the tactile feedback from the lamb's carcasses demonstrated outstanding anatomical correlation and also demonstrated similar difficulties to human chest drain insertion. Both the anterior and mid-axillary lines were clearly visualized as well as the costal margins. There was also the opportunity to demonstrate administration of local anaesthetic agents as well as one of the most common pitfalls of chest tube insertion: "hitting the bone". The session was received very well and positive/constructive/critical feedback revealed that the session was the appropriate length with both an appropriate amount of time spent on instruction and demonstration. Feedback also revealed that the students felt comfortable with the equipment used.

CONCLUSION: Lamb's thoraces are a superb medium for simulation-based instruction of chest tube insertion. The use of an animal model has its benefits with respect to anatomical realism and the tactile realism of feeling actual muscle and bone. It likely provided a good stepping-stone between abstract classroom insertion instruction and hospital patient insertion. It would be a useful follow up note to suggest a head-to-head comparison of common chest tube insertion plastic trainers with animal models.

HYPERTROPHIC AIRWAY SMOOTH MUSCLE MASS CORRELATES WITH INCREASED AIRWAYS RESPONSIVENESS IN A CHRONIC MURINE MODEL OF ALLERGIC ASTHMA

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*Deceased

RATIONALE: The increase in airway smooth muscle (ASM) mass observed in asthma results from muscle hypertrophy and hyperplasia, yet there is little evidence correlating these changes with functional effects.

METHODS: We performed a ventilator-based assessment of respiratory mechanics and responsiveness to methacholine in murine models of acute (3 wk) and chronic (12 wk) ovalbumin-induced airway inflammation. Using the Flexivent system and constant-phase modeling to differentiate between airway and peripheral tissue responses, we correlated functional changes (airways Newtonian resistance [RN], peripheral tissue resistance [G] and elastance [H]), with the relative contribution of bronchial smooth muscle cell proliferation, hypertrophy and apoptosis to increased ASM mass.

RESULTS: Indices of increased airways hyper-reactivity were observed in both the acute and chronic models. Morphometric analyses of treated (ovalbumin-sensitized and –challenged; OVA/OVA) and control (ovalbumin- sensitized and saline-challenged; OVA/PBS) lungs, showed an increase in ASM area of chronic, but not acute, OVA/OVA mice, which correlated directly with the airways Newtonian resistance in response to methacholine. In contrast, in the acute model, none of the parameters of responsiveness to methacholine correlated with the airway smooth muscle content. Rather, the acute model exhibited significantly greater active proliferation of bronchial smooth muscle, which correlated with increased parameters of peripheral lung tissue dampening and elastance; concomitant diminished apoptosis was also observed. This response resolved completely in the chronic 12 week model where the increased muscle mass that was laid down demonstrated hypertrophic growth.

CONCLUSIONS: We demonstrate a distinct temporal response in murine airways to antigenic challenge with ASM proliferation and diminished apoptosis occurring in the acute model, leaving a hypertrophied ASM mass that correlates with increased airways Newtonian resistance in chronic OVA/OVA treated mice. Identification of a functionally relevant hypertrophic smooth muscle mass highlights the possibility of regulation of airway muscle hypertrophy as a novel therapeutic target in asthma.

Financial Support: *This research was supported by the Canadian Institutes of Health Research (operating grants to JB and MW), Keenan Centre Summer Student Research Award, St Michael's Hospital (AW), AllerGen NCE and National Sanatorium Association (JAS), and CIHR/Ontario Thoracic Society Doctoral Awards (MN)*

STACHYBOTRYS CHARTARUM (*S CHARTARUM*, THE BLACK MOLD) ALTERS EXPRESSION OF PULMONARY SURFACTANT PROTEINS IN FETAL RAT LUNG CELLS

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Moulds are constant contributors to air pollution particularly to air quality in buildings. The spores themselves or their volatile organic products are present in variable amounts in almost all environments, particularly in buildings affected by flooding. These moulds and products can account for the sick building syndrome and have been tied to such occurrences as the outbreak of pulmonary hemosiderosis in infants in Cleveland several years ago.

RATIONALE: While past studies have focused on the effects of *S chartarum* spores on surfactant in terms of composition and quantity, very little has been done to investigate the effects of *S chartarum* toxins on surfactant protein expression in the developing lung. The results of these studies will establish an *in vitro* model for monitoring environmental toxins and provide a knowledge base to be utilized in future studies.

METHODS: *S chartarum* toxins obtained by agitating spores in saline were incubated with cultures of several cell types. Lung A549 cells, a continuously growing cell line derived from surfactant producing type II alveolar cells, isolated fetal lung type II cells and fetal lung fibroblasts were used. MTT formazan assays were employed to test cell viability. The synthesis and release of the predominant surfactant protein A (SP-A), which is involved in reducing surface tension, and surfactant protein B (SP-B) involved in shuttling phospholipids between surfactant subcompartments was also assessed. Antibodies to these proteins (available commercially) and western blotting results were used to assess the quantity of protein produced by the various cell types. Electron microscopy was used to examine changes in cellular structure of control and *S chartarum*-treated cells.

CONCLUSIONS: Exposure to the *S chartarum* toxins had negative effects on fetal lung epithelial cells and their ability to produce pulmonary surfactant. *S. chartarum* toxins induce deleterious changes to the developing fetal lung in terms of expression of SP-A and SP-B as well as to the surface tension reducing abilities of their produced pulmonary surfactant. However ultrastructurally no spore associated changes were apparent in the isolated lung cells.

Financial Support: *NSERC, Biology of Breathing Group, Manitoba Institute of Child Health*

IMPROVED BIOAVAILABILITY OF EPOXY-EICOSATRIENOIC ACIDS REDUCES TP-RECEPTOR-AGONIST-INDUCED TENSION IN HUMAN BRONCHI

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Epoxy-eicosatrienoic acid and thromboxane A_2 are arachidonic-acid derivatives. The former has initially been defined as an epithelium-derived hyperpolarizing factor (EDHF) displaying broncho-relaxing (4) and anti-inflammatory properties, as recently demonstrated (Morin et al 2009), whereas thromboxane A_2 induces vaso- and bronchoconstriction upon binding to TP-receptor. Epoxy-eicosatrienoic acids, however, are quickly degraded by the soluble epoxide hydrolase (sEH) into inactive diol compounds. The aim of this study was to investigate the effects of 14, 15-epoxy-eicosatrienoic acid (EET) on TP-receptor activation in human bronchi. Tension measurements performed on native bronchi from various species, acutely treated with increasing 14, 15-EET concentrations, revealed specific and concentration-dependent relationships as well as a decrease in the tension induced by 30 nM U-46619, used as a synthetic TP-receptor agonist. Interestingly, acute treatments with 3 μM MS-PPOH, an epoxygenase inhibitor, which minimizes endogenous production of EET, resulted in an increased reactivity to U-46619. Furthermore, we demonstrated that chronic treatments with t-AUCB, a sEH inhibitor, reduced human bronchi reactivity to U-46619. During our tension measurements, we also observed that human bronchi generated small-amplitude contractions; these spontaneous activities were reduced upon acute 14, 15-EET treatments in the presence of t-AUCB. Altogether, these data demonstrate that endogenous and exogenous 14, 15-EET could interfere with the activation of TP-receptors as well as with spontaneous oscillations in human-airway smooth-muscle tissues.

This work was supported by a grant from the Faculty of Medicine and Health Sciences and the CRC E-LeBel of the CHUS to E.R.

Epidemiology of Lung Diseases / Épidémiologie de Maladies Pulmonaires

COPD SURVEILLANCE IN CANADA: AN UPDATE

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RATIONALE: It was estimated that national COPD prevalence based on self-reported diagnosis was underestimated by as much as 50%. The Public Health Agency of Canada's (PHAC) chronic respiratory disease surveillance program has recently expanded COPD surveillance to include the use of health administrative data and spirometry measures.

METHODS: Estimates of self-reported diagnosed COPD were obtained from the 2008 Canadian Community Health Survey (CCHS), which sampled 62,187 individuals aged ≥12 years. Spirometry measures were obtained from the 2007-2009 Canadian Health Measures Survey, which sampled 5604 individuals aged 6 to 79 years. Spirometry data were analysed using predictive equations from 'Hankinson (NHANES III)'. Both surveys were conducted by Statistics Canada and were representative of the Canadian population.

Estimates of treated COPD prevalence for the 2007/08 fiscal year were obtained from the PHAC Canadian Chronic Disease Surveillance System (CCDSS). The CCDSS links provincial and territorial physician billing, hospitalization, and health insurance registry data. Treated COPD was defined by ICD-9 codes 491, 492, or 496 in the first field of a physician claim or in any field of a hospitalization separation, ever.

RESULTS: An estimated 1.3 million (8.1%) Canadians have lung function measures of GOLD stage ≥II, which is comparable to the prevalence of treated COPD (8.2%) from the PHAC CCDSS.

TABLE 1
COPD prevalence by definition, Canadians aged ≥35 years (95% confidence intervals)

Definition	Surveillance period (years)	Prevalence (%)
Self-reported health professional diagnosis	2008	4.8 (4.5-5.1)
Treated COPD	2007/08	8.2 (8.2-8.2)
GOLD stage I	2007-2009	8.5 (7.1-9.9)
GOLD stage II	2007-2009	7.1 (5.5-8.8)
GOLD stage III or IV	2007-2009	0.9 (0.4-1.5)
GOLD stage ≥II	2007-2009	8.1 (6.2-10.0)

CONCLUSION: Estimating the prevalence of COPD using self-reported physician diagnosis has inherent limitations. National spirometry measures and health administrative data can enhance understanding of COPD in the population.

Funding: *PHAC*

VALIDATION OF A SURVEY-BASED METHOD TO ASSESS ASTHMA CONTROL

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RATIONALE: Reliable measures of asthma control (AC) are essential for epidemiological studies of asthma to identify risk factors and detect trends in the population.

OBJECTIVE: Develop and validate an algorithm to assess AC using items from the International Study of Asthma and Allergies in Children (ISAAC) survey.

METHODS: 102 children with asthma aged 10-12 years, randomly sampled from a population-based cohort of 5619 Toronto schoolchildren, participated in a nested case-control study between 2009 and 2010. Data were collected by parental responses to ISAAC-based questions. An algorithm that incorporated number of exacerbations, sleep disturbance and speech limitation due to wheeze, wheeze with exercise, nocturnal cough, and hospitalization for respiratory problems was adapted from Global Initiative for Asthma guidelines to assess AC. Participants were categorized as asymptomatic (AS), partially controlled (PC), or not controlled (NC). This algorithm was validated against three criterion measures of AC: FEV_1, the Childhood Asthma Control Test(C-ACT), and a physician's assessment. Pearson correlations were calculated between the AC algorithm and each criterion measure. Kruskal-Wallis Test was used to determine statistical differences in mean criterion scores between AC groups.

RESULTS: 101 children with asthma could be classified by the AC algorithm. Mean age was 10.4 years, 64.4% were male, and 26 (25.7%), 44 (43.6%), and 31 (30.7%) of children were categorized as AS, PC and NC, respectively. The groups' mean C-ACT scores were 25.9, 23.2, and 21.9 ($p<0.0001$ for differences between groups) and mean FEV_1 were 97.3%, 92.1% and 86.6% ($p=0.0103$) for AS, PC, and NC, respectively. Pearson coefficients for correlation between AC and criterion measures were 0.51 ($p<0.001$) for C-ACT scores, 0.31 ($p=0.0014$) for FEV1, and 0.33 ($p=0.0011$) for physician's assessment.

CONCLUSIONS: An AC algorithm adapted from ISAAC questions is a valid measure of AC in children. It may be a useful epidemiological tool that provides an efficient analysis of AC within large datasets.

Funding: *Ontario Thoracic Society*

TOWARD PROVIDING PATIENT-CENTRED CARE FOR ABORIGINAL CLIENTS WITH ASTHMA AND COPD

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RATIONALE: The Ontario Ministry of Health and Long-Term Care, Acute Services Division, commissioned an environmental scan to examine the prevalence of Asthma and COPD among First Nations, Métis and

Inuit people in Ontario, the factors effecting their access to respiratory care, and the Aboriginal-specific, patient-centred respiratory health initiatives that might be applied in Ontario.
METHODS: Data were compiled from a review of 116 Canadian and international papers and reports; analysis of Aboriginal statistics for Ontario in the Canadian Community Health Survey (2005/6); and in-depth interviews with 23 health administrators and front-line caregivers at 13 health agencies serving Aboriginal clients across the province.
RESULTS: The available evidence indicates asthma and COPD prevalence rates among Ontario's Aboriginal residents are twice the provincial norm. Clients are generally unaware of lifestyle and environmental risks and links to other health conditions. Their access to care is effected by limited resources and relative isolation combined with high mobility, as well as trust and language issues. Moreover, clinical complications often result from poor compliance with plans of care.
CONCLUSIONS: The study identified various patient-centred, Aboriginal-specific approaches applicable across the spectrum of care. For example, clinical advice must recognize and respect both personal circumstances and cultural practices (e.g. smudge ceremonies); teaching should incorporate the visual and oral orientation common to Aboriginal cultures, rather than relying on print-based messaging; and community members should be involved in developing and doing respiratory health promotion work.

PREVALENCE OF ASTHMA IN ABORIGINALS AND NON-ABORIGINALS: A SYSTEMATIC REVIEW OF EPIDEMIOLOGICAL STUDIES

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RATIONALE: Previous systematic reviews (SR) have examined asthma prevalence in the general population. The aim of this SR was to evaluate whether asthma prevalence differs between non-Aboriginals and Aboriginals.
METHODS: MEDLINE, EMBASE, Circumpolar Health Bibliographic Database and Native Health Database (1966 to October 2009), reference lists and journal searches were conducted to identify epidemiological studies that compared asthma prevalence between Aboriginal and non-Aboriginal adult populations from Australia, New Zealand, United States or Canada. Two reviewers independently assessed study eligibility and methodological quality. Pooled odds ratios (OR) and 95 percent confidence intervals (95% CI) were calculated and heterogeneity was measured using I2.
RESULTS: From 129 potentially relevant citations, eight cross-sectional studies were included. Ethnicities in the studies were Native Americans (including Alaska Natives), Canadian Aboriginals (First Nations, Métis and Inuit), Australian Aboriginals, and New Zealand Maori. Overall, Aboriginals were 1.41 more likely to report having asthma than non-Aboriginals (pooled OR = 1.41; 95% CI: 1.23, 1.60). Results were heterogeneous (I2 = 92%). Subgroup analysis by country showed that Canadian Aboriginals (pooled OR=1.80; 95% CI: 1.68, 1.93), Native Americans (OR=1.41; 95% CI: 1.13, 1.76) and Maori were significantly more likely to report asthma (OR=1.64; 95% CI 1.40, 1.91) than non-Aboriginals. Alternatively, Australian Aboriginals were significantly less likely to report asthma (pooled OR=0.49; 95% CI: 0.28, 0.86). There were no differences in asthma prevalence between Aboriginal males and females and their non-Aboriginal counterparts (males OR=0.84; 95% CI: 0.46, 1.56 and females OR=1.26; 95% CI: 0.70, 2.27).
CONCLUSIONS: A gap in asthma-related health status between Aboriginal and non-Aboriginals exist in a variety of settings and countries. Listed among the top 25 disorders with the greatest burden of disease worldwide, asthma carries the potential for health inequalities affecting vulnerable groups in our society. Further evidence-base investigations should be conducted to address and reduce respiratory health inequalities.
Financial Support: *Alberta Health and Wellness/Public Health Agency of Canada*

ASTHMA MORTALITY AND HEALTH SERVICES UTILIZATION IN ABORIGINALS AND NON-ABORIGINALS: A SYSTEMATIC REVIEW OF EPIDEMIOLOGICAL STUDIES

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RATIONALE: Despite efforts to improve the respiratory health status of the general population, it is unknown whether inequities affect asthma health indicators in Aboriginal groups. This systematic review evaluated whether asthma mortality and health services utilization differ between non-Aboriginals and Aboriginals.
METHODS: MEDLINE, EMBASE, Circumpolar Health Bibliographic Database and Native Health Database (1966 to October 2009), reference lists and journal searches were conducted to identify epidemiological studies that compared asthma mortality and health services utilization use (hospitalization, emergency department [ED] visits, asthma medication and spirometry use) between Aboriginal and non-Aboriginal adult populations from Australia, New Zealand, United States or Canada. Two reviewers independently assessed study eligibility and methodological quality. Median rate ratios (RR) and interquartile ranges (IQR) were calculated.
RESULTS: From 129 potentially relevant citations, 10 retrospective analytical cohort studies were included. Three studies compared asthma mortality rates in New Zealand Maori versus non-Aboriginals (median RR = 2.54; IQR: 2.36, 4.05). Five studies compared asthma hospitalization rates in Native Americans, New Zealand Maori, Canadian Aboriginals, and Australian Aboriginals versus non-Aboriginals (median RR = 2.06; IQR: 1.91, 3). Three studies comparing ED visits due to asthma exacerbations between Aboriginals (Native Americans and Canadian Aboriginals) and non-Aboriginals consistently showed that Aboriginals were more likely to visit the ED for asthma exacerbations. One study failed to identify statistically significant differences in the use of prescribed asthma medication between Native Americans and non-Aboriginals (mean times per month: 2.3 versus 2.4; $p > 0.05$). Evidence from one study showed that Canadian First Nations Aboriginals were less likely to access spirometry testing compared to non-Aboriginals.
CONCLUSIONS: Differences between Aboriginals and non-Aboriginals in asthma health outcomes and access to care were identified. Efforts to address the causes of these inequalities are urgently needed, including programs that go beyond the health care system.
Financial Support: *Alberta Health and Wellness/Public Health Agency of Canada*

PREVALENCE OF CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN ABORIGINALS: A SYSTEMATIC REVIEW OF EPIDEMIOLOGICAL STUDIES

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RATIONALE: Previous systematic reviews have examined the frequency of chronic obstructive pulmonary disease (COPD) in the general population with prevalence estimates ranging from 0.2% to 18.3%. No systematic reviews have provided separate epidemiological data for COPD in Aboriginal adult populations.The aim of this SR was to evaluate the prevalence of COPD among aboriginals and whether these estimates differ from those of non-Aboriginals.
METHODS: MEDLINE, EMBASE, Circumpolar Health Bibliographic Database and Native Health Database (1966 to October 2009), reference lists and journal searches were conducted to identify epidemiological studies that assessed the prevalence of COPD in Aboriginals and/or compared it with that of non-Aboriginal adults from Australia, New Zealand, United States or Canada. Two reviewers independently assessed study eligibility and methodological quality. Median prevalence estimates with interquartile ranges (IQR) were used to summarize descriptive data and odds ratios (OR), and 95 percent confidence intervals (95% CI) were reported for between-group comparisons.
RESULTS: From 129 potentially relevant citations, one retrospective cohort and three cross-sectional studies were included. Ethnicities that were

represented in the studies included Arctic-region Aboriginals, Native Americans, Australian Aboriginals and New Zealand Tokelauans. The median overall COPD prevalence in Aboriginals was 6.6% (IQR: 5.4, 9.3). Median COPD prevalence for Aboriginal males and females were 6.6 (IQR: 5.4, 9.3) and 4.6 (IQR: 3.4, 5.7), respectively. One cross-sectional study compared COPD prevalence rates between Aboriginals and non-Aboriginals and found that Native Americans were not more likely to report having COPD than non-Aboriginals (OR = 1.08; 95% CI: 0.81, 1.44).

CONCLUSIONS: To date, limited evidence exists on differences in the prevalence of COPD between Aboriginal and non-Aboriginal populations. Variations in prevalence estimates are likely attributed to differences in case ascertainment methods and COPD definitions. Research in COPD health disparities is necessary to develop interventions that are sensitive to special populations.

Financial Support: *Alberta Health and Wellness/Public Health Agency of Canada*

CHRONIC OBSTRUCTIVE PULMONARY DISEASE MORTALITY AND HEALTH SERVICES UTILIZATION IN ABORIGINALS AND NON-ABORIGINALS: A SYSTEMATIC REVIEW OF EPIDEMIOLOGICAL STUDIES

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RATIONALE: Aboriginal status is a key social determinant of health that contributes to health disparities and care inequalities. It is unclear whether the burden of disease and health services utilization for chronic obstructive pulmonary disease (COPD) differ between non-Aboriginals and Aboriginals. This systematic review addresses these issues.

METHODS: MEDLINE, EMBASE, Circumpolar Health Bibliographic Database and Native Health Database (1966 to October 2009), reference lists and journal searches were conducted to identify epidemiological studies that compared COPD mortality and hospitalization rates (hospitalization, emergency department [ED] visits, medication and spirometry use) between Aboriginal and non-Aboriginal adult populations from Australia, New Zealand, United States or Canada. Two reviewers independently assessed study eligibility and methodological quality. Median rate ratios (RR) and interquartile ranges (IQR) were used for data summary.

RESULTS: From 129 potentially relevant citations, nine retrospective analytical cohort studies compared COPD mortality between non-Aboriginals, Native Americans (six studies) and Australian Aboriginals (three studies). Heterogeneity and incomplete reporting of mortality measures precluded pooled analyses of mortality data from studies. Australian Aboriginals (RR: 6.49; IQR: 0.8, 2.3; 1 study) and Alaska Natives (median RR = 1.5; IQR: 1.4, 1.5; 2 studies) were more likely to have deaths attributed to COPD than non-Aboriginals. Analyses by sex showed similar results (median RR: males = 1.4; IQR: 0.8, 1.5; females = 1.5; IQR: 0.8, 1.5). One study showed that Australian Aboriginals were more likely to be hospitalized for COPD compared to non-Aboriginals (median RR: 8.6; IQR: 8.43, 16). Similar results were found for ED visits, medication and spirometry use.

CONCLUSIONS: Aboriginals and non-Aboriginals differ in the mortality attributed to COPD and the use of health services; however data are sparse. Future studies should expand the knowledge base to document these inequalities and improve the methods of reporting if meaningful comparisons between studies are to be made.

Financial Support: *Alberta Health and Wellness/Public Health Agency of Canada*

PREVALENCE OF CHRONIC BRONCHITIS IN FARMING AND NON-FARMING RURAL PEOPLE

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RATIONALE: Smoking, obesity, inadequate housing, income, and airborne pollutants have been significantly associated with the prevalence of chronic bronchitis (CB). The aim of the current study was to determine the prevalence of CB and associated risk factors in farming and non-farming rural people.

METHOD: We conducted a baseline mail out survey (the first phase of the Saskatchewan Rural Health Study) in 2010 of 11,102 households located in four geographical regions (Northwest, Southwest, Southeast, and Northeast) of Saskatchewan, Canada. We obtained completed questionnaires from 4623 households (8263 individuals). The questionnaire collected information on individual and contextual determinants from the farm and small town cohorts and a history of ever being diagnosed with chronic bronchitis (outcome variable). The clustering effect within households was adjusted using Generalized Estimating Equations.

RESULTS: The prevalence of CB was 7.0% and 5.9% in non-farm and farm residents respectively. CB prevalence was the lowest in the northwest farming (7.9%) region of the province and the highest in the southeast non-farming (11.6%) region. We found that the prevalence of CB is associated with the following factors: first degree relatives diagnosed with lung disease, worksite exposures: asbestos dust [Odds ratio (95% Confidence Interval)=1.53 (1.08, 2.17)], diesel fumes [1.39 (1.07, 1.80)], molds [1.48 (1.16, 1.89)], household income: low income [2.22 (1.56, 3.16)], lower middle [1.19 (0.89, 1.58)], upper middle [0.91 (0.67, 1.24)], household cigarette smoking [1.40 (1.01, 1.93], and difficult to access routine health care [1.30 (1.01, 1.68)]. Two significant interactions [body mass index*sex ($p<0.05$), smoking status*age ($p<0.10$)] were found.

CONCLUSIONS: Our results suggest that significant determinants of CB are positive family history of lung disease, worksite exposures, household income, household cigarette smoking, and difficulty in accessing routine health care. Obesity increases the risk of CB among females compared to obese males. Current smoking status increases the risk of CB (among rural population <45 years) but not for non-smoking and ex-smoking status.

Financial Support: *Funded by Canadian Institutes of Health Research*

VALIDATING A QUESTIONNAIRE DIAGNOSIS OF ASTHMA USING A GUIDELINES-BASED GOLD STANDARD

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RATIONALE: The objective of this study was to validate a "questionnaire diagnosis" against the gold standard "clinical diagnosis" of asthma in a population-based sample of school children.

METHODS: We completed a nested case-control study from January 2009 to October 2010. 102 asthma cases and 106 controls were randomly sampled from a population-based cohort of 5619 schoolchildren. The participants underwent a clinical assessment by a physician who categorized children as having definite, possible or no asthma. These children then completed spirometry, a methacholine challenge (tidal breathing technique), exhaled nitric oxide and allergy skin testing.

A "questionnaire diagnosis" of asthma was defined by affirmative responses to "Has your child ever been diagnosed with asthma?" and "Was this diagnosed by a physician?". A "clinical diagnosis" of asthma required a physician assessment of asthma and objective findings of reversible airway obstruction (methacholine PC20<16 mg/ml or 12% bronchodilator response. The sensitivity, specificity, and kappa of the "questionnaire diagnosis" were calculated using the "clinical diagnosis" as the gold standard.

RESULTS: 208 children (58% male, mean age 10 years) participated (response rate 65%) and 204 (98%) completed all measurements. "Questionnaire diagnosis" of asthma was sensitive (82.61%) but not specific (70.68%) compared to the "clinical diagnosis". There was weak agreement between the questionnaire and clinical diagnosis (kappa=0.48). When the analysis was done for current asthma, the specificity and kappa improved (82.98%, 0.56) but the sensitivity decreased (75.00%).

CONCLUSION: Questionnaire diagnosis of asthma has good sensitivity but poor specificity compared to the gold standard clinical diagnosis. This may lead to misclassification bias in epidemiologic studies that rely on parental report of asthma diagnosis.

Financial Support: *The Lung Association Grant-in-Aid program*

COPD and Asthma: Treatment and Biomarkers / MPOC et asthme: traitement et marqueurs biologiques

INVESTIGATION OF RESIDUAL LUNG INHOMOGENEITY IN WELL-CONTROLLED ASTHMATICS

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RATIONALE: Asthma is the most common chronic disease of childhood, yet traditional pulmonary function parameters may not be useful in monitoring pediatric asthmatic lung disease. The lung clearance index (LCI) is a sensitive measure of small airways obstruction, and can be performed by children of all ages. However, few studies have assessed its utility in well-controlled asthmatics.

METHODS: Stable patients previously diagnosed with asthma were recruited. Informed consent was obtained from patients, who then completed medical and ISAAC questionnaires, spirometry, and LCI measurements pre and post inhaled bronchodilator. Comparisons were made between groups using two-tailed t-tests.

RESULTS: Twenty-four well-controlled asthmatic patients were recruited. Seventeen (71%) were male. The mean (range) age of patients was 7.0 (3-16) years. None had day or night symptoms, or short-acting bronchodilator use within the past 4 weeks. Seventeen (71%) were on daily inhaled corticosteroids. Four (17%) received concurrent therapy with a long-acting beta agonist and eight (33%) with montelukast.

Of the 11 patients six years and older, 9 completed acceptable spirometry. The mean percentage predicted ±SD (*z*-score) FEV1, FVC, and FEV_1/FVC were 88.7±7.7 (–0.91±0.60), 93.0±10.5 (–0.55±0.84), and 95.1±6.8 (0.61±0.89). None had a significant bronchodilator response.

All but one patient completed acceptable LCI manoeuvres. Mean (±SD) LCI was 7.0±1.3 at baseline, significantly higher than our population normal values (6.3±0.5, $p<0.002$). Post-bronchodilator LCI was not different from baseline, but remained elevated compared to controls (6.8±1.5, $p<0.03$).

CONCLUSIONS: More children can perform LCI measurements acceptably as compared to spirometry. LCI at baseline was significantly higher in asthmatics and remained elevated after bronchodilator use, suggesting residual ventilation inhomogeneity. Further study is required to better characterize LCI in this population and the clinical significance of these abnormalities.

Financial Support: *AllerGen, Morrisons, CIHR, Ontario Thoracic Society, SickKids Transplant Centre*

CHART REVIEW INITIATIVE TO EVALUATE THE MANAGEMENT OF SEVERE ASTHMA IN CANADIAN CLINICAL PRACTICE

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RATIONALE: The objective of this initiative was to identify potential management gaps in the treatment of patients with severe asthma in real-life clinical practice in Canada.

METHODS: Participating respirologists used an online platform to complete patient profiles for severe asthma patients in their practice who were considered adherent to therapy, based either on pharmacy records or clinical judgment. Information collected included data on demographics, smoking status, relevant comorbidities, perceived asthma control, measures of asthma control, and changes made to asthma therapy at the last visit. Having completed the chart review, participants were asked whether their perception of the patient's control had changed and whether they would consider making changes to the patient's asthma therapy.

RESULTS: A total of 26 physicians entered information on 399 severe asthma patients, 299 who were considered adherent based on clinical judgment alone, 81 whose adherence was confirmed using pharmacy records and 19 who were determined to be non-adherent from pharmacy records and who were excluded from analyses. Overall, 74% of adherent patients were perceived to be "well" or "moderately" controlled. However, based on Canadian guidelines criteria only 17% would be considered controlled. Chart review prompted re-evaluation of level of control in only 16% of patients, but triggered consideration of changes to asthma therapy in 34% of patients, with addition of a new medication being suggested in 45% of these cases. A subanalysis comparing patients whose adherence was determined based on pharmacy records vs. on clinical judgment revealed no major differences.

CONCLUSIONS: Physicians may have difficulty identifying adherent patients using clinical judgment alone. There also appears to be a gap between perceived and actual levels of asthma control, with chart review prompting therapy changes in over one-third of patients.

Financial Support: *This initiative was made possible through the support of Novartis Pharmaceuticals Canada Inc*

A COMPARISON OF THE EFFECTIVENESS OF INHALED LONG-ACTING BETA-2-AGONIST AND LONG-ACTING ANTICHOLINERGIC MEDICATION IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

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RATIONALE: Chronic obstructive pulmonary disease (COPD) is the fourth leading cause of death in North America and one of the most common causes of hospitalization. Effective, evidence-based treatments for COPD are crucial, both to optimize care and ease its burden on the health care system. Inhaled long-acting beta-2-agonists and long-acting anticholinergics are both recommended management for moderate COPD, but their relative effectiveness has never been established. Therefore, the current study was conducted to compare survival between COPD patients treated with different classes of long-acting inhaled bronchodilators.

METHODS: An observational, population-based, longitudinal cohort study using health administrative data from Ontario, Canada was conducted. Patients consisted of all individuals aged 66 years and older with COPD who were living in Ontario between 2003 and 2006. Patients who received a new prescription of an inhaled long-acting beta-2-agonist were compared to those who received a new prescription for a long-acting anticholinergic. The outcome was all-cause mortality. Primary analysis was done using propensity score matching and Cox proportional hazards regression analysis. Results were confirmed with propensity score calibration to ensure that unmeasured confounders did not bias the findings. The intent-to-treat analysis was complimented by a time-on-medication analysis to ensure that the results were robust.

RESULTS: Patients prescribed a long-acting anticholinergic had a higher risk of death compared to patients prescribed a long-acting beta-agonist (hazard ratio 1.14, 95% confidence interval 1.09 to 1.19).

CONCLUSIONS: In our study, patients with COPD initially prescribed a long-acting beta-2-agonist had slightly greater survival than those prescribed a long-acting anticholinergic.

Financial Support: *Drug Innovation Fund, Ontario Ministry of Health and Long-Term Care*

INTEGRATED APPROACH TO DIAGNOSIS OF ASSOCIATED OCCUPATIONAL ASTHMA AND RHINITIS

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BACKGROUND: There is strong immunopathologic evidence concerning the link between upper and lower respiratory inflammation in allergic disease. The Sacré-Coeur Hospital is seeking to implement an integrated approach to evaluate patients complaining of work-related rhinitis and asthma symptoms.

OBJECTIVES: We present a case of associated Occupational Rhinitis (OR) and Occupational Asthma (OA) to illustrate the parallel assessment of bronchial and nasal physiological responses to specific inhalation challenge (SIC) in laboratory.

CASE: A 38-year-old woman (an animal lab technician since 2004) first noticed, in 2007, the appearance of rhinitis and conjunctivitis symptoms when she was exposed to rats. Symptoms improved on weekends and holidays. Chest examination was normal and nose examination was suggestive of allergic rhinitis. A skin-prick test with rat extract was strongly positive (wheel of 10 × 5 mm). Her FEV_1 (2.69 L) was normal and PC_{20} was 3.7 mg/mL. SIC with parallel assessment of nasal and bronchial responses was conducted following the usual protocol. After a control day of exposure with lactose, the patient underwent SIC by the realistic method within an exposure chamber. Working conditions were simulated by manipulating rat litters used at the workplace. After 10 minutes of exposition, she developed rhinitis and conjunctivitis, her FEV_1 dropped by 27.5% and her nasal volume measured by acoustic rhinometry dropped by 80% from baseline values. Induced sputum and nasal lavage examination 30 minutes after exposure demonstrated eosinophilia (respectively 11% and 20%). A diagnosis of associated OA and OR was confirmed and she was advised to stop working with rats.

CONCLUSION: This case illustrates well the integrated diagnostic approach for patients who complain about work-related respiratory symptoms and the importance of assessing nasal as well as bronchial responses during SIC.

ROFLUMILAST (DAXAS™) FOR THE TREATMENT OF COPD IN CANADA: VALUE FOR MONEY?

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RATIONALE: In Canada, COPD is the leading cause of hospitalizations amongst chronic diseases. New therapies in severe COPD are needed for optimal management, to improve disease outcomes and quality of life. Roflumilast, first in a new class of drugs, improves lung function and reduces exacerbations when added on to a long-acting bronchodilator. From a provincial ministry of health perspective, the current analysis examined the incremental cost-utility of roflumilast in severe COPD, comparing:

1) Roflumilast + tiotropium versus tiotropium alone.
2) Roflumilast + tiotropium versus tiotropium + ICS/LABA (triple therapy).

METHODS: A five year Markov transition model was developed with three health states: 1) severe COPD; 2) very severe COPD and 3) death. All patients entered the model with severe COPD. Health state transitions were based on published estimates of lung function decline (FEV_1). Within each live health state there was a chance of moderate or severe exacerbations. Efficacy was based on (Fabbri et al & Calverley et al, 2009) and (Aaron et al 2007). Relative rate reduction of exacerbations ranged from 0.77 to 0.85 and was set to 46 ml for FEV_1 improvement. Resource use was obtained from treatment guidelines and clinical expert opinion. Utility estimates were from roflumilast studies and the published literature. Costs and outcomes were discounted at 5% annually. Incremental cost-utility ratios (ICURs) based on a probabilistic model were reported with one-way deterministic sensitivity analyses.

RESULTS: Roflumilast plus tiotropium had ICURs of $34,550 per QALY gained compared to tiotropium alone. The regimen of tiotropium plus ICS/LABA generated an incremental cost of $3,429 and an incremental QALY of 0.0040 compared to roflumilast plus tiotropium, resulting in an ICUR of $847,166 for triple therapy. Results were most sensitive to the relative risk reduction of moderate to severe exacerbations.

CONCLUSIONS: Within the expected willingness to pay threshold of $50,000 per QALY gained, roflumilast plus tiotropium therapy offers acceptable value for money for the treatment of severe COPD in Canada.

Financial Support: *Nycomed Canada Inc*

CLINICAL CHARACTERISTICS OF WOMEN WITH MENSTRUAL-LINKED ASTHMA

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BACKGROUND: The menstrual cycle is reported to influence the clinical course of asthma in 20-40% of women. Clarifying the phenotypic characteristics of menstrual-linked asthma (MLA) is an important first step in modelling pathophysiologic mechanisms and potential treatment strategies.

OBJECTIVE: To define the clinical characteristics of women with menstrual-linked asthma.

METHODS: A comprehensive health questionnaire was administered to all female asthma subjects in two primary care community asthma projects and a tertiary care asthma centre. Female subjects aged 12 – 55 years self-identified with MLA.

RESULTS: The prevalence of MLA was 69/540 (13%). Women with MLA had more urgent/emergent asthma-related healthcare visits in the previous 12 months (6.30 (SD=±6.79) vs. 4.71 (SD=±5.91) (p=0.019)), including more Emergency Room visits (1.48 (SD=±3.36) vs. 0.88 (SD=±2.27) (p=0.014)), and more hospitalizations (0.26 (SD=±0.93) vs. 0.09 (SD=±0.50) (p=0.044)) than women without MLA. Women with MLA had higher asthma-related absenteeism than women without MLA (36/69 (54%) vs. 170/471 (37%) (p=0.008)). MLA subjects used more α_2-agonist rescue doses/day (1.16 (SD=±1.67) vs. 0.73 (SD=±1.35) (p=0.012)). Women with MLA reported more eczema (23/69 (34%) vs. 87/471 (19%) (p=0.004)), heart disease (8/69 (12%) vs. 15/471 (3%) (p=0.005)), and rheumatoid arthritis (8/69 (12%) vs. 22/471 (5%) (p=0.013)).

CONCLUSION: MLA is a distinct asthma phenotype characterized by severe exacerbations and high α_2-agonist utilization. Women with MLA have a higher incidence of co-morbid illness including heart disease, eczema, and rheumatoid arthritis. Accurate phenotyping and identifying co-morbidities will help direct future investigation.

Financial Support: *Provided by a grant for the University of Western Ontario and St Joseph's Health Care Asthma Centre*

THE FRACTION OF EXHALED NITRIC OXIDE AS A PREDICTOR OF EXACERBATION AMONG SEVERE ASTHMATICS

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BACKGROUND: The clinical utility of the fraction of exhaled nitric oxide (FeNO) to predict exacerbations among severe asthmatics remains uncertain.

METHODS: Subjects were recruited as part of a Difficult Asthma Program that follows severe asthmatics over a 1 year period with monthly clinical assessments that include spirometry and FeNO measurements. Exacerbations, defined by the prescription of oral corticosteroids for <30 days because of asthma symptoms, are also documented. Patients eligible for this analysis must have experienced at least one exacerbation during the study period. FeNO measurements from the initial assessment, the visit immediately following an exacerbation and the final visit were not included in the analysis.

RESULTS: Seven out of 36 severe asthmatics experienced a total of 11 exacerbations during the study period (mean age 49 yrs; 43% female; FEV_1/FVC 55%; best FEV_1 68%; lowest FEV_1 52%). Mean FeNO at the visit prior to or at the time exacerbation was 41 ppb (n=13, 95% CI: 24-57 ppb) compared to 16 ppb (n=47, 95% CI: 14-19) at visits that were not followed by exacerbation. An FeNO threshold of 30 ppb gives sensitivity of 69% and specificity of 92% with positive and negative likelihood ratios of 8.5 and 0.35, respectively. The area under the receiver-operator curve for FeNO was greater than FEV_1 (absolute and % predicted for prediction of subsequent exacerbation.
SUMMARY: Among a cohort of severe asthmatics that experience exacerbations, routine measurement of FeNO had predictive value toward subsequent exacerbation requiring oral corticosteroids. In this small study, an FeNO threshold of 30 ppb carried a positive likelihood ratio of exacerbation of 8.5. Increases in FeNO were detectable up to 30 days prior to exacerbation. These observations suggest routine measurement of FeNO may be a useful clinical tool in the management of severe asthmatics. A larger observational study to validate these results is warranted.
Financial Support: *The Richard and Edith Strauss Canada Foundation*

INTEGRATING LUNG AND PLASMA EXPRESSION OF PNEUMO-PROTEINS IN DEVELOPING BIOMARKERS IN COPD: A CASE STUDY OF SURFACTANT PROTEIN D

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RATIONALE: Surfactant protein D (SP-D) is a promising blood biomarker in patients with chronic obstructive pulmonary disease (COPD). Nevertheless, circulating levels of SP-D are not related to pulmonary functions. In the present exploratory study, we created a simple index of plasma to bronchoalveolar lavage (BAL) fluid ratio of SP-D (pSP-D/bSP-D), and determined whether this index would relate to the severity of airflow limitation and, hence, represent a superior biomarker than pSP-D alone in smokers.
PATIENTS AND METHODS: In 50 ex and current smokers (mean age 57.6±7.8 years, 74% men), SP-D was measured in BAL fluid and plasma samples, and the relationships between spirometric variables and a composite parameter – the pSP-D/bSP-D ratio – were determined.
RESULTS: There was a significant inverse correlation between the pSP-D/bSP-D ratio and the severity of airflow obstruction, as measured by FEV_1/FVC (p=0.012). In contrast, no relationship was observed between FEV_1/FVC and pSP-D alone.
CONCLUSION: We suggest that integrating both lung and plasma expression of pneumo-proteins may be more useful than plasma expression alone in developing pneumo-proteins as potential biomarkers in COPD.
Financial Support: *APVV-0122-06, and VEGA 1/0348/09 of the Ministry of Education, Slovakia; USPHS Grant N01-CN85188 from the National Cancer Institute and The Canadian Institutes of Health Research*

ASSOCIATION BETWEEN CHANGING SMOKING STATUS AND ASTHMA SYMPTOM CONTROL: A LONGITUDINAL OBSERVATIONAL STUDY

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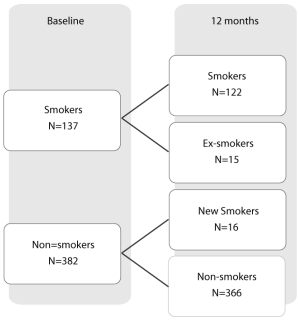
RATIONALE: Cigarette smoke is a serious trigger for asthma exacerbations. Control of their asthma symptoms may be difficult among smokers, if as studies have suggested, they are much less responsive to asthma medications effective in non-smokers with asthma. Our objective was to measure the impact of the change of smoking status on asthma symptoms in adults with asthma.
METHODS: Patients ≥19 years with asthma at eight community health practices in Ontario were invited to participate in an evidence-based primary care asthma program in 2003-2006, and were followed for 12 months. Information such as smoking status, asthma-related symptoms, and health services use were collected by questionnaire. The analysis included only those with data about current smoking status at both baseline and follow-up visits. Mixed effect models were used to measure the impact of the change in smoking status on asthma symptoms.
RESULTS: Of the 519 patients included, 137 (26%) were smokers at baseline and most (89%) remained smokers during the study. The majority (96%) of patients who were non-smokers at baseline, remained as such, but a small proportion did start smoking by the end of the study. Those who quit smoking during the study were less likely to experience asthma symptoms, such as wheeze, chest tightness, and night-time symptoms, than those who remained smokers (Figure 1). Patients who started smoking were more likely to experience these same asthma symptoms than non-smokers as well as current smokers.



Characteristic									
Wheeze		Chest Tightness		Night-time Symptoms		Day-time Symptoms		>1 Asthma Attacks in Last 6 months	
n	%	n	%	n	%	n	%	n	%
81	66.4	74	60.7	66	54.1	110	90.2	69	63.9
5	33.3	2	13.3	2	13.3	12	80.0	4	33.3
13	81.3	10	62.5	11	68.8	16	100.0	9	60.0
179	48.9	184	50.3	145	40.2	294	80.3	185	56.6

Figure 1) *Impact of change in smoking status on asthma symptoms*

CONCLUSIONS: Our study showed that individuals with asthma who quit smoking gained better control over their asthma symptoms than those who continued to smoke, suggesting that future asthma programs that target smoking cessation should have a longer follow-up period to monitor how the patients' change in smoking status has impacted asthma control.
Financial Support: *Government of Ontario*

PSYCHOSOCIAL COMORBIDITY IN SEVERE ASTHMA: EXPERIENCE FROM A REGIONAL SEVERE ASTHMA CENTER IN WESTERN CANADA

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RATIONALE: Severe asthma (SA) accounts for the majority of health-related costs from asthma. The evaluation of patients with SA benefits from a systematic approach which includes the identification and management of co-morbid illness. Psychosocial co-morbidity (PSCM) in SA can take many forms, including panic disorder, generalized anxiety disorder, dysthymia, depression and other conditions, both concurrent and premorbid. Prior work has suggested that anxiety and depression are associated with asthma. However, dyspnea related to anxiety and depression can mimic asthma, which can result in inappropriate escalation of asthma anti-inflammatory therapy if not recognized and effectively managed. We show preliminary results related to formal incorporation of measures of psychosocial comorbidity as part of the systematic evaluation of patients referred for specialist assessment of SA.
METHODS: Retrospective chart review of patients recently evaluated through the Edmonton Regional Severe Asthma Clinic (ERSAC). A standardized evaluation tool was used to assess psychological health: The Mini-International Neuropsychiatric Interview screen (MINI screen) (www.medical-outcomes.com/index.php).
RESULTS: Charts were reviewed for 17 individuals with moderate and severe asthma who had completed a standardized *assessment and optimization protocol* (www.severeasthma.ca). A little under half of the patients were on systemic steroids (8 out of 17). Eleven of 17 had adult onset asthma. Average age was 47 (range 19-81). Five were male and 12 were

female. Ten of the 17 patients screened positive with the MINI screen. Problems identified included depressive episode, dysthymia, panic disorder, agoraphobia, social phobia, obsessive compulsive disorder, post-traumatic stress disorder, general anxiety disorder, manic episode, and substance/alcohol abuse. Positive screens resulted in Psychiatry interventions through ERSAC.

CONCLUSION: Psychological co-morbidity is common in patients with SA. The MINI screen is a useful clinical tool to evaluate patients with SA as part of a systematic assessment and optimization process. Broader use of this clinical evaluative tool may modify asthma severity by timely recognition and appropriate intervention.

Financial Support: *None*

Promoting Lifestyle Interventions / Promotion d'interventions sur les habitudes de vie

CHANGES IN BODY WEIGHT AND PHYSICAL PERFORMANCE AFTER RECEIVING DIETARY ADVICE IN PATIENTS WITH CHRONIC OBSTRUCTIVE PULMONARY DISEASE: ONE-YEAR FOLLOW-UP

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BACKGROUND: Nutritional studies in patients with Chronic Obstructive Pulmonary Disease (COPD) are often based on oral nutritional supplementation and are of short duration. Our aim was to study the changes in body weight and physical performance in COPD patients after receiving the dietary advice for one year.

METHODS: Thirty six patients with COPD as a primary diagnosis (mean age 68.5±7.8 years, FEV_1 % predicted 38.2±14.2), referred to a pulmonary rehabilitation programme were studied. Each patient received dietary advice individually. Body weight, height and energy intake were measured at baseline, whereas body weight and energy intake measurements were repeated at three months and at one year of follow-up. Handgrip strength and 12-minute walking test were carried out in the beginning, at 3 months and at the end of the study.

RESULTS: Body weight had increased significantly by 1.3 kg (p = 0.02) and walking distance by 83.2 m (p = 0.007) after 1 year. There was an increase in mean handgrip strength after 1 year (1.6 kg, p = 0.07). The mean intake of energy and protein expressed as percent of energy and protein requirement had increased after 1 year (15%, $p < 0.001$, and 5.6%, p = 0.09, respectively). Handgrip strength correlated significantly with energy (r = 0.53, p = 0.002), fat (r = 0.50, p = 0.02) and protein intake (r = 0.41, p = 0.002) after 1 year.

CONCLUSION: Positive effects on body weight, handgrip strength and walking distance in patients with COPD were seen after receiving dietary advice individually with a one year follow-up.

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Financial Support: *This study was financially supported by the National Patient Federation for Heart and Lung diseases in Sweden and the University of Umeå*

A SHARED VOICE: ENGAGING FIRST NATIONS AND INUIT COMMUNITIES IN THE DEVELOPMENT OF CULTURALLY APPROPRIATE ASTHMA AND ALLERGY EDUCATION MATERIALS AND RESOURCES FOR YOUTH AND THEIR FAMILIES

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RATIONALE: The prevalence of asthma and associated allergies is higher in First Nations and Inuit communities than in the general Canadian population. The main project purpose was to assess the relevance of existing asthma education materials and resources to First Nations and Inuit communities, and identify how these materials could be adapted to be culturally appropriate.

METHODS: Three sources of data were used to compile the findings. First, 68 asthma assessment packages and questionnaires were completed by Aboriginal community members. Second, five webinars with 56 participants in total were conducted. Third, an Advisory Group was created to discuss potential barriers to receiving asthma education.

RESULTS: Aboriginal community members valued interactivity, visual features of materials, and personal interaction. Newly developed materials should focus on practical and lifestyle issues of asthma management. Participants also preferred a combination of traditional printed and digital resources. Cultural relevance could be improved by including images related to Aboriginal culture, featuring personal stories, and making materials available in Aboriginal languages.

CONCLUSIONS: The findings support five key recommendations. Firstly, there should be a focus on the development of culturally appropriate asthma educational materials and resources. Secondly, implementation of asthma educational activities for children should be a priority. Thirdly, education should target broader community members to increase community awareness of asthma. A fourth recommendation is to ensure appropriate access to educational resources in the communities. Finally, it is crucial to continue engaging First Nations and Inuit community members in the development/adaption of asthma educational materials and community-based programs.

Financial Support: *We would like to extend our thanks to the First Nations and Inuit Health Branch (FNIHB), Health Canada for providing funds for this important project*

TESTING AN EMPOWERMENT INTERVENTION TO HELP PARENTS MAKE HOMES SMOKE-FREE: A RANDOMIZED CONTROLLED TRIAL

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RATIONALE: One in twenty Canadian children aged 0-11 years are exposed to environmental tobacco smoke (ETS) in the home, predisposing them to multiple health problems. The objective of this randomized controlled trial was to test if parents' participation in an intervention based on an empowerment ideology and participatory experiences decreased the number of cigarettes smoked in homes where children = 5 years resided.

METHODS: Sixty families were randomized to the intervention (n=30) or control (n=30) groups. The intervention included three weekly group sessions followed by three weekly follow-up telephone calls over six consecutive weeks. During group sessions, parents shared experiences about ETS, identified personal strengths and resources, and developed action plans. Data were collected in interviewer-administered questionnaires at baseline and six months follow-up.

RESULTS: Ninety-three percent of the sample consisted of mothers, 77% of whom smoked during pregnancy. Forty-two percent of the total sample reported a household income of <$15,000. The median number of cigarettes smoked in the home daily decreased from 18 to 4 in the total sample however no statistically significant difference was detected between groups at six months follow-up.

CONCLUSIONS: Participation in the study, independent of group, may have resulted in parents decreasing the number of cigarettes smoked in the home. Valuable lessons were learned about recruiting and working with this group of parents, all of whom faced challenges associated with tobacco, and almost half of whom lived in poverty.

Financial Support: *Canadian Tobacco Control Research Initiative, Canadian Nurses Respiratory Society, Canadian Nurses Foundation Nursing Care Partnership, PEI Lung Association and PEI Cancer Control*

SELF-ASSESSMENT IN ASTHMA CONTROL BEFORE AND AFTER THE PATIENT EDUCATION

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Many studies have shown the benefits of asthma education in adult patients. A preliminary survey among the CHUM's patients had shown an improvement in asthma control after an education session. We aimed to study the effectiveness of the asthma education center in our hospital. We conducted a phone survey to assess the patients' ability of long term self assessment of their asthma control. 122 patients who participated in an education session between October 2006 and July 2008 were contacted. We collected data about the patients self assessment of asthma control, the asthma control according to the Canadian guidelines, the number of exacerbations, use of the action plan, use of prednisone, emergency room visits, hospitalizations and urgent clinic visits for the year preceding and following the educative session. 86% of the patients were properly assessing their level of asthma control, from which 77% had optimal control, 8% had one criteria of uncontrolled asthma and 1% had two or more criteria of uncontrolled asthma. 12% of the patients were over estimating their control and 2% underestimating. A nice correlation was observed where 88% of patients believed their asthma was well controlled when well-controlled asthma according to the Canadian guidelines was established at 77%. The number of acute exacerbations (342 vs 65), emergency room visits (115 vs 13), urgent clinic visits (60 vs 13) and use of prednisone (67 vs 16) were all significantly ($p<0.001$) lower in the year following the education session. Furthermore, no hospitalization (12 vs 0, $p = 0.001$) occurred in the year after the education. Surprisingly, we have shown that most patients (86%) were able to accurately self assess the control of their asthma at long term. Education gives the patients a better understanding of the disease and of its control criteria, and allows a significant improvement in asthma control.

ASSESSING CONTINUING EDUCATION NEEDS OF ASTHMA EDUCATORS: WHAT ARE THE PRIORITIES?

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RATIONALE: Asthma educators from many health disciplines provide a valuable service in the care and management of asthma for Canadian populations. Up to date professional knowledge remains pivotal in the provision of asthma care that meets the needs of clients.

METHODS: We surveyed 413 graduates of the Asthma*Trec* educator program (1999-2009) developed by the Saskatchewan and Manitoba Lung Associations. Questionnaires provided by the researcher were mailed by the Asthma*Trec* coordinator using a modified Dillman mail out survey method. The survey was conducted between May and July 2009.

RESULTS: There were 298 educators from across Canada who responded to the survey for a very good response rate of 71.2%. Of those who responded, 62.5% were certified asthma educators. The three main groups of educators were respiratory therapists followed by nurses and pharmacists (49.3%, 26.0% and 16.2%, respectively). Most educators (90.2%) were using their learned skills in practice. Reported barriers to updating asthma knowledge were educators were too busy, had difficulty obtaining time off work, experienced financial constraints or the distance to educational activities was a barrier. Continuing learning needs perceived as most important included pharmacotherapy, triggers of asthma, research findings on asthma management and assessing asthma severity and control although preferred choices varied by professional group ($p<0.05$). The CTS Guidelines for asthma management and information from the internet were the most commonly sought sources for updating asthma knowledge.

CONCLUSION: The CTS recommendation for asthma care was a major learning resource for these health professionals and as such, needs to be as current as possible. Internet access may remove some of the barriers experienced gaining access to information. Content for continuing education should take into consideration preferred information needed by each professional group.

Financial Support: *Canadian Respiratory Health Professionals of the Canadian Lung Association and Canadian Nurses Foundation*

HOW DOES THE TIMING OF HOME ENVIRONMENTAL TOBACCO SMOKE EXPOSURE DURING CHILDHOOD AFFECT THE AGE OF ASTHMA DEVELOPMENT?

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RATIONALE: To evaluate the relationship between age of home exposure to environmental tobacco smoke (ETS) and age of asthma development.

METHODS: In phase 1 of the Toronto Child Health Evaluation Questionnaire, parents of 5619 grade 1-2 students attending 283 randomly sampled public and Catholic schools reported age of physician-diagnosed asthma development and exposure to maternal ETS during pregnancy and the first year of life. In phase 2, a nested case-control study in which half of the children had asthma or wheezing, parents of 1497 students reported any ETS exposure in all homes inhabited by the child until age 7 years. Using the Cox's proportional hazards model, we evaluated the relationship between timing of ETS exposure and age of asthma development.

RESULTS: In phase 1, maternal smoking was reported in 5.0% during pregnancy and 7.8% during the child's first year; these proportions were similar for the subset participating in phase 2 (5.6% and 8.4%, respectively), and yearly home ETS exposure (12-14%) decreased over the first 7 years of life. Hazard ratios adjusted for sex, parental atopy and income adequacy suggested that children exposed to maternal ETS during pregnancy (1.32, 95% CI: 1.05-1.68) and their first year (1.17, 95% CI: 0.93-1.47) developed asthma sooner. Similarly, children with any home ETS exposure in each of the first 7 years trended towards earlier asthma development. However, the total number of years exposed to maternal ETS and the number of cigarettes smoked in the house per day did not appear to be associated with the age of asthma development.

CONCLUSION: Home ETS exposure was associated with earlier development of physician-diagnosed asthma. Longitudinal analysis will be used to further evaluate the timing of home ETS exposure and its contribution to the age of asthma development.

Financial Support: *Canadian Lung Association/Canadian Thoracic Society, The Hospital for Sick Children, AllerGen*

AWARENESS OF RISK FACTORS AND ATTITUDES TOWARDS LUNG DISEASE AMONG CANADIANS MOST AT RISK

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The Canadian Lung Association Advisory Committee

OBJECTIVE: To assess awareness and perceptions about risk factors associated with chronic obstructive pulmonary disease [COPD], lung cancer and sleep apnea among Canadians determined to have risk factors for the development of these diseases.

METHODS: A quantitative hybrid survey was delivered to a representative Canadian population including First Nations, Inuit and Metis people [FNIMP], that had at least one risk factor for development of any one of the three diseases identified.

RESULTS: A total of 3626 individuals were contacted and 84% [3036] were eligible to participate. Of those at risk for lung cancer and COPD, 65% and 69% respectively were due to tobacco smoke exposure. 72% of those at risk for lung cancer felt they were somewhat knowledgeable about the disease, its cause and symptoms. However only 36% of persons at risk for COPD and 56% of persons at risk for sleep apnea felt they were aware

of the cause, common symptoms or treatment of the disease. 13% of those at risk for COPD were not even aware of the term "COPD" or "chronic obstructive pulmonary disease". Furthermore, 27% of persons at risk for COPD did not know or did not believe that smoking was a risk factor for development of COPD. Most participants believed that smoking was an addiction [77%] rather than a habit [19%] and this attitude was shared equally amongst smokers and non-smokers. No measured difference was seen in awareness of lung disease between FNIMP and the general Canadian population.

CONCLUSIONS: Canadians at risk for lung disease are reasonably aware of risk factors and symptoms for lung cancer and sleep apnea. However, knowledge of COPD and its risk factors was poor considering the burden of this disease. Knowledge of the impact of lifestyle choices and change were generally not well appreciated in this large Canadian study population.

Financial Support: *This project was funded by the Public Health Agency of Canada under the Lung Health Program in support of the National Lung Health Framework*

SMOKER'S PREFERENCE FOR PHARMACOLOGICAL AND BEHAVIOURAL CESSATION TREATMENTS

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BACKGROUND: Poor uptake and/or adherence to smoking cessation treatments and the addictive nature of nicotine are recognized as possible mechanisms explaining low rates of abstinence or quit rates for smoking cessation interventions. Perceived acceptability of and preferences for treatment may contribute to this poor uptake and adherence. However, there is limited knowledge of adult smokers' perceived acceptability and preferences for smoking cessation interventions and of factors related to these preferences.

PURPOSE: The objectives of this study were 1) to examine adult smokers' preferences for pharmacological (i.e., nicotine gum) and behavioral (i.e., individual brief advice and group counseling) therapy, and 2) to explore the factors (socio-demographic and clinical characteristics, and treatment attributes related to those preferences.

METHOD: A cross-sectional design was used. Adult smokers (n = 81) were provided with descriptions of three treatments, then completed a questionnaire assessing socio-demographic and clinical characteristics of participants, as well as perception of treatment attributes and preferences for the three treatments. Data analysis included descriptive statistics and logistic regression, which examined the relationships between the selected factors and expressed preferences.

RESULTS: More than half (58%) of participants chose group counseling, 44% favored nicotine gum and 16% preferred individual brief advice. Socio-demographic and clinical characteristics were not associated with expressed treatment preferences whereas treatment attributes were. Specifically, perceived suitability to lifestyle related to preference for nicotine gum; willingness to comply related to preference for individual brief advice; and effectiveness in managing cravings related to preference for group counseling.

IMPLICATIONS: The findings of this study suggest that smokers have preferences for smoking cessation interventions and they consider attributes of the treatment when making choices. Providing individuals with their preferred treatment may enhance adherence to and satisfaction with treatment, as well as outcome achievement.

Financial Support: *Funding was provided by a CRHP Grant Award from the Lung Association*

EFFECTS OF INTEGRATING REGULAR EXERCISE WITH SMOKING CESSATION SUPPORT ON SMOKING ABSTINENCE AND PHYSICAL ACTIVITY LEVELS: A STUDY OF THE QUIT AND GET FIT PROGRAM

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Evidence from cross-sectional and randomized control studies suggests that pursuing regular exercise during a quit attempt can improve quit rates and reduce nicotine withdrawal symptoms and cravings. The *Quit & Get Fit* pilot program implemented in Ontario integrated smoking cessation support with personal training sessions for physical activity. Over the course of 6 weeks, 124 smokers received 12 personal training sessions and cessation support from a specially trained personal trainer. An evaluation was conducted to assess the effects of the program on participants' smoking and physical activity behaviours. Data were collected through web-based baseline and follow-up surveys. At the end of intervention, 44.3% of participants were abstinent from smoking for 30 days preceding the follow-up (the intention-to-treat (ITT) quit rate – 31.5%) and 34.1% achieved 6-week continuous abstinence (ITT – 24.2%). Significant predictors of quitting included participants' age, confidence in quitting and satisfaction with personal trainer's support. There were also some positive changes among participants who remained smokers at the end of intervention (55.7%). Compared to the base-line, more smokers started to have their first cigarette beyond 1 hour after waking (26% vs. 62%, P=0.001). The average number of cigarettes smoked per day decreased from 14.5 to 6.4 (P=0.001). Both smokers and quitters tended to increase the frequency and amount of their physical activity over time. The study further reveals that the increased frequency of vigorous activity was associated with the 30-day smoking abstinence at the end of the program (P=0.03). The findings suggest that *Quit & Get Fit* is a promising intervention for promoting smoking cessation, reducing consumption of cigarettes and increasing engagement in physical activity. The 3-month follow-up has now been completed and analysis is underway to verify these results.

Financial Support: *The project was funded by the Ontario Lung Association and the Ministry of Health Promotion and Sport*

Pulmonary Rehabilitation / Réadaption pulmonaire

OPTIMAL DURATION OF PULMONARY REHABILITATION FOR INDIVIDUALS WITH COPD: A SYSTEMATIC REVIEW

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RATIONALE: There is currently no consensus regarding the optimal duration of pulmonary rehabilitation for individuals with chronic obstructive pulmonary disease (COPD). Therefore the objective of this review was to determine the impact of duration of pulmonary rehabilitation on measures of health-related quality of life and exercise tolerance in COPD.

METHODS: Randomized controlled trials (RCTs) comparing different lengths of pulmonary rehabilitation in patients with COPD were identified after searches of six electronic databases (MEDLINE, PubMed, CINAHL, EMBASE, Physiotherapy Evidence Database (PEDro) and the Cochrane Library of clinical trials) and reference lists of pertinent articles. Two reviewers performed the searches and assessed trial quality using PEDro and Jadad scales.

RESULTS: Five RCTs met inclusion criteria. The mean PEDro score was 6 (range 3-8) and mean Jadad was 2 (range 1-3). Three trials reported a difference in health-related quality of life in favour of the longer duration program; two trials reported a benefit in exercise capacity in favour of longer programs. A meta-analysis of results was not possible due to considerable heterogeneity in program duration and outcomes.

CONCLUSIONS: Longer duration pulmonary rehabilitation programs have a more favourable effect on health-related quality of life in individuals with COPD; results for exercise capacity are less clear. The limited literature prevents a more definitive conclusion on optimal duration of rehabilitation.

Financial Support: *Marla Beauchamp is supported by the Canadian Institutes of Health Research and Dina Brooks is supported by a Canada Research Chair*

DOES A PULMONARY REHABILITATION PROGRAM INFLUENCE BODE INDEX SCORES OF COPD PATIENTS?

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RATIONALE: The BODE (B- body mass index; O- airflow obstruction; D- dyspnea; E- exercise capacity) is an important index to predict mortality in COPD. Pulmonary rehabilitation (PR) improves exercise tolerance, dyspnea and quality of life. However, few studies in Brazil have investigated the changes in the BODE index of COPD patients submitted to a Pulmonary Rehabilitation program. Therefore, we aimed to analyze the BODE index of COPD patients enrolled in a Pulmonary Rehabilitation Program.

METHODS: This quantitative study comprised 30 medical records of COPD patients, independent of gender and age, submitted to a PR located in the city of Fortaleza, Ceara, Brazil. The study was approved by the ethics committee of the Messejana Hospital and was conducted between September, 2009 and March, 2010. The BODE index was calculated at admission and at discharge of the PR program. The following variables were used to calculate the index: six-minute walking distance (6-MWD), Medical Research Council Dyspnea Score (MRC); body mass index (BMI), Percent of Predicted Forced Expiratory Volume at one second (VEF1% predicted). Statistical analysis was performed using Statistical Package for the Social Sciences (SPSS), version 17. Paired Student's t-test was performed to analyze the differences of FEV1%, BMI, 6MWT, MRC and BODE index at the beginning and at discharge from the PR program. The level of significance was set at $p<0.05$.

RESULTS: The BODE index of COPD patients enrolled in a Pulmonary Rehabilitation program showed significant improvements (p=0.046) at discharge of the program. Significant improvements in the degree of dyspnea measured by the MRC (p=0.000) were found, but not in 6MWT (p=0,240), VEF1 (% predicted) (p=0,408) or BMI (p=0,183) at discharge.

CONCLUSION: Participation in a Pulmonary Rehabilitation Program improves BODE index scores demonstrating the benefits of this form of therapy for COPD patients.

Financial Support: *No financial support was provided for this study*

VALVED HOLDING CHAMBER (VHC) WITH INSPIRATORY FLOW INDICATOR AS PATIENT FEEDBACK AID HAS EQUIVALENCE TO PRESSURIZED METERED DOSE INHALER (PMDI) ALONE BASED ON THERAPEUTICALLY BENEFICIAL PORTION OF DOSE

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RATIONALE: The *Flow-Vu** Inspiratory Flow Indicator (IFI) is an important new feedback aid for care-givers and patients using the *AeroChamber Plus** *Flow-Vu** Anti-Static VHC (Trudell Medical Inc., London, Ontario) with mouthpiece as part of disease management for asthma or COPD. Healthcare providers require that the modification has not affected the delivery of the therapeutically beneficial portion of the emitted dose from the inhaler.

METHODS: *In vitro* measurements (n=5 VHCs/group) of fine particle mass/actuation for albuterol (100 µg/actuation label claim dose, GSK Canada Inc.) as a representative bronchodilator were made using an Andersen 8-stage cascade impactor equipped with a USP/Ph.Eur. induction port and operated at 28.3 L/min±5%. Benchmark data were obtained for the pMDI alone (no delay between actuation and sampling) and for the pMDI + VHC (2-second delay, simulating poor coordination for which VHCs are often prescribed. The movement of the *Flow-Vu* Indicator was employed as a monitor of airflow through the VHC and a proper seal of the mouthpiece in the apparatus. The VHCs were tested out-of-package in accordance with instructions. Recovery and assay for the collected active pharmaceutical ingredient (API) was undertaken by HPLC-UV spectrophotometry.

RESULTS: Fine particle mass/actuation for the pMDI alone was 34.8±1.4 µg, compared with 33.2±3.3 µg/actuation for the pMDI + VHC group. The *Flow-Vu* Indicator was observed to move from the inhalation valve closed to open position immediately upon initiation of sampling.

CONCLUSION: The *Flow-Vu* Indicator provided useful feedback on the delivery of this widely prescribed 'rescue' medication and did not interfere with the new VHC delivering a substantially comparable mass of the fine portion of the aerosol <4.7 µm in diameter to that from the pMDI alone when a short delay existed, as is likely with many users of this class of inhaler.

Financial Support*: The authors are employees of Trudell Medical International, which funded the study*

CHARACTERISTICS OF LUNG TRANSPLANT REHABILITATION PROGRAMS IN CANADA

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RATIONALE: Lung transplant candidates demonstrate significant decreases in exercise capacity, muscle strength and health-related quality of life. Subsequently, a prolonged hospitalization and side-effects of immunosuppressive therapy in lung transplant recipients can lead to osteoporosis, decreased exercise capacity, muscle atrophy and dysfunction. Rehabilitation programs are an integral part of medical management pre- and post-lung transplant. Little is known of the specific structure, content and organization of existing lung transplant rehabilitation programs. The purpose of this study was to conduct a national survey to characterize lung transplant rehabilitation programs in Canada.

METHODOLOGY: A 24 item descriptive survey was sent to all adult and pediatric lung transplant centres in Canada. Responses were categorized and analyzed using frequencies and percentages.

RESULTS: Four out of six lung transplant centres responded to the survey (67% response rate). Rehabilitation programs offered aerobic exercise, strength training and education done primarily in an outpatient setting. Pre-transplant, exercise was prescribed for the duration of the waiting list with a frequency of 2 to 5 days a week for 90 to 120 minutes. Post-transplant, rehabilitation was prescribed for 6 to 12 weeks with a frequency of 2 to 3 days a week for 90 to 120 minutes. Exercise intensity and progression was primarily determined by oxygen saturation, target heart rate and levels of perceived exertion pre-transplant, and by individualized assessment, perceived exertion and post-operative precautions post-transplant. The most common modes of exercise were walking/treadmill, cycling, upper and lower strength training and flexibility. The most commonly used outcome measure was the six-minute walk test. The primary healthcare professionals involved in the rehabilitation program were dietitians, nurses and physiotherapists.

CONCLUSIONS: The majority of lung transplant programs recommended rehabilitation pre-transplant and had mandatory rehabilitation post-transplant. A pulmonary rehabilitation model was used with the inclusion of educational topics specific to lung transplant and the incorporation of post-transplant precautions for exercise training.

Financial Support: *University of Toronto*

EFFECTIVENESS OF INVOLUNTARY BREATH STACKING IN CHILDREN WITH NEUROMUSCULAR DISEASE

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RATIONALE: Respiratory insufficiency is one of the most common causes of death in patients with neuromuscular disorders (NMD). Due to weakness and cognitive level, children with NMD often cannot perform required maneuvers to recruit lung volume. In cooperative adults, breath stacking with a mask and one-way valve can obtain significantly higher lung volumes.

METHODS: To study the effectiveness of a breath stacking mask in patients with NMD, we recruited 23 children (17 male, 6 female) over 3 years, mean age 11 y (range 3-19 y) and body mass 43.8 kg (range 12-80 kg). Fifteen were cognitively aware and able to communicate verbally.

For involuntary breath stacking (IVB) a one-way valve and pneumotach were attached to a cushioned mask that was held to the face, covering around nose and mouth with a tight seal. Flow signals were acquired by computer (AcqKnowledge BIOPAC Inc.). Tidal volumes (Vt) and minute ventilation (VE) were calculated from the recording for 30 s before and 30 s after 15 s of valve closure during which expiration was prevented. Oxygen saturation (SaO_2) was measured.

RESULTS: The mean Vt before valve closure was 290 ml (range 29-598 ml). The mean increase in volume by stacking was 600±560 ml (range –140 to 3,000 ml). Normalized to body weight, the mean increase above normal end inspiratory level was 15±14.7 ml/kg (range 2.7 – 52.2 ml/kg). The mean number of stacked breaths was 4.5±3.6 (range 0-17). VE increased on average by 18% after stacking ($p<0.05$, paired t-test). There was no change in SaO_2 after stacking. Four of the 23 children did not stack.

CONCLUSIONS: We found that breath stacking with a mask and a one-way valve can achieve breath volumes approximately 3× normal Vt. The mask was tolerated well, and cooperation of the child was not required.

Financial Support: *This study was supported by the Manitoba Institute of Child Health and the Health Sciences Centre Foundation*

PATIENT'S ABILITY TO DETERMINE WHEN TO REPLENISH THEIR INHALERS (PMDI)

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RATIONALE: The U.S. FDA has long contended that patients are not able to keep track of their aerosol medications, leaving them vulnerable to unwittingly running out of medication. However, the majority of studies supporting this viewpoint rely on surveys and anecdotal evidence. In contrast, this study looks at the physical evidence: that is the contents of inhalers returned to pharmacies by consumers for disposal.

METHODS: Each month a random sampling of post consumer inhalers (N=250 + 250) are collected from a government-regulated facility for evaluation. Samples are from retail pharmacies, not institutions. The samples are sorted, weighed, cataloged and the number of remaining doses is determined. In Canada only Advair has an on-board counting mechanism. For that reason it is used as control.

RESULTS: Over 50% of the control group samples showed zero doses remaining (plus or minus 20%) compared with only 10% of the inhalers without counters. 15% of the pMDIs were found to be substantially depleted with less than -20 doses remaining. This suggests that patients may have been without medication for a minimum of 3 days and in many cases for multiple weeks. The remaining 70% of the inhalers had between 21% and 99% of their medication remaining. 5% of inhalers returned for disposal were full, most unprimed.

CONCLUSION: The FDA's assertion that patients are unable to manage their inhaled medications holds true. The results also suggest that knowledge of the number of remaining doses fundamentally changes how patients use their inhalers. If it were public policy that inhalers be equipped with counting mechanisms or that pharmacists be required to weigh inhalers to determine the remaining doses before replenishing them the public would be safer, patient compliance would improve and the amount of waste could be reduced.

Financial Support: *No funding*

CARDIAC REHABILITATION AND RESPIRATORY COMORBIDITIES: CHARACTERIZATION AND COMPARISON OF AEROBIC AND FUNCTIONAL PROFILES – A RETROSPECTIVE REVIEW

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BACKGROUND AND RATIONALE: There is currently little information on the prevalence and impact of respiratory comorbidities on patients in cardiac rehabilitation (CR).

OBJECTIVE: To compare the efficacy of CR for individuals with cardiac disease and 1) respiratory comorbidities (chronic obstructive pulmonary disease) (RC); 2) non-respiratory comorbidity(s) (NRC); and 3) no comorbidities (NC).

METHODS: Retrospective review of the Toronto Rehab CR database (January 1999 – May 2004). The following were compared (all with a primary cardiac diagnosis and ≥10 pack per year (ppy) smoking history): patients with 1) RC; 2) NRC; and 3) NC. Primary outcomes were (at 0-, 6- and 12-months) cardiopulmonary exercise max heart rate (HR), max workload, PeakVO_2 and anaerobic threshold (AT). Analyses included factorial ANOVA and logistic regression.

RESULTS: Of 5922 patients, 77 (1.6%) had RC; 957 (16.2%) NRC; and 213 (3.6%) NC. The number of patients who completed the program did not differ between groups. RC, compared to the other 2 groups (except max HR) and; NRC compared to NC had significantly lower (all $p<0.008$; in mean (SD); RC, NRC, and NC respectively) 1) max HR (bpm): 117.2 (21.6), 123.3 (23.0), 125.8 (23.2); 2) max workload (kilopond meters): 660.2 (232.6), 820.5 (264.5), 878.1 (237.5); 3) peak VO_2 (mL kg^{-1} min^{-1}): 16.7 (3.8), 19.9 (5.8), 21.3 (6.0); and 4) AT (mL kg^{-1} min^{-1}): 11.8 (2.1), 13.3 (3.5), 13.9 (3.9). There were significant differences over time but none of the interactions between group and time were significant.

CONCLUSION: Prevalence of COPD in the Toronto Rehab CR database is low and likely underestimated. RC patients had poorer functional status compared to NRC and NC; NRC compared to NC. The number of patients who completed the program and the relative improvements in functional status attributable to CR were similar for all groups. A CR model may be effective for patients with COPD. Having both cardiac and respiratory programs available may increase the accessibility to rehabilitation for these patients.

Financial Support: *Dr Nonoyama was supported by a Toronto Rehabilitation Institute post doctoral fellowship. Dr Brooks holds a Canada Research Chair*

COMPARING ADULT SUCTIONING PRACTICES AMONG PHYSIOTHERAPISTS, RESPIRATORY THERAPISTS AND NURSES

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RATIONALE: Physiotherapists (PT), nurses (RN), and respiratory therapists (RT) use suctioning to promote secretion clearance and/or maintain a patent airway. However, suctioning is invasive and not without risk; therefore it is important for clinicians to use evidence-informed practice. A survey of suctioning practices of PT, RN and RT in Ontario was last conducted in 1997. The purpose of this study was to compare adult suctioning practice among PT, RT and RN, and to identify any changes in practice

since the earlier survey and subsequent publication of a clinical practice guideline (CPG).

METHODS: 450 PT, RT and RN were randomly selected from clinicians identified by each professional college as performing suctioning. A questionnaire based on the previous suctioning practice survey was revised, pilot tested, and then distributed using a 5-step modified Dillman process. Responses among the three professions in this survey and between this survey and the 1997 survey were compared using Chi-square tests.

RESULTS: The overall response rate was 40% (180/450; PT-42%, RT-40%, and RN-38%). There was no difference in years of suctioning experience, but PT suctioned less often per shift than RT or RN ($p<0.001$). Nurses considered 'patient refusal' as a contraindication for suctioning intubated patients less often than either PT or RT ($p<0.001$). There was no difference in use of hyperoxygenation or saline instillation, while RN 'routinely' used hyperinflation more than either RT or PT ($p=0.03$). For non-intubated patients, RT 'always' wore droplet protection masks more than either PT or RN ($p=0.01$); more PT and RN 'never' wore such protection ($p=0.01$).

CONCLUSIONS: Within the limitations of survey data, suctioning practices in adult patients were generally similar among PT, RT and RN. However not all professions have followed recommendations made in the most recent (2001) evidence-based CPG, and personal protective equipment is not being worn on a regular basis.

Financial Support: *The Lung Association / Ontario Respiratory Care Society Research Grant*

PHYSICAL ACTIVITY IN LUNG TRANSPLANT CANDIDATES

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RATIONALE: Rehabilitation is an integral part of the medical management of lung transplant candidates to improve surgical fitness and prevent progressive deconditioning and immobility that can accompany end-stage lung disease. Little is known about physical activity (PA) in lung transplant candidates. The study objectives were to characterize daily PA in lung transplant candidates and explore associations between PA and clinical measures of lower extremity strength, functional exercise capacity, and health-related quality of life (HRQOL).

METHODS: Lung transplant candidates were assessed prospectively. Daily PA was measured over seven days using a tri-axial accelerometer (ActiLife GT3X). Additional clinical measures included isometric peak torque of the knee extensors using a Biodex dynamometer, functional exercise capacity using the six-minute walk test (6MWT), and HRQOL using the physical functioning scale of the Medical Outcomes Short Form (SF-36) and the activity scale of the St. George Respiratory Questionnaire (SGRQ). Physical activity was quantified in terms of steps per day and time spent in moderately intense PA. Correlation analysis was used to explore the relationship between PA and knee extensor strength, exercise capacity and HRQOL.

RESULTS: 21 lung transplant candidates (11 men, aged 52±15 years, listed 5.2±3.7 months) from various diagnostic groups (interstitial lung disease=11, cystic fibrosis=4, COPD=2, bronchiectasis=1, pulmonary hypertension=1, sarcoidosis=1, polymyositis=1) were studied. Lung transplant candidates walked 3057±1227 steps per day and spent 7.7±7.6 minutes per day in moderately intense activity. Moderate correlations were found between the 6MWT and daily steps ($r = 0.52$, $p = 0.04$) and moderate intensity PA ($r = 0.7$, $p = 0.004$). No significant correlations were found between PA and knee extensor strength or HRQOL.

CONCLUSIONS: Lung transplant candidates have low levels of daily PA. Despite enrollment in a rehabilitation program three times a week, lung transplant candidates spent little time in moderately intense PA. A longitudinal study is currently being done to assess changes in PA following lung transplant.

Financial Support: *ORCS, CRHP and CRC*

Mycobacterial Disease / Maladie mycobactérienne

TREATMENT OF LATENT TUBERCULOSIS INFECTION DIAGNOSED DURING PRE-EMPLOYMENT SCREENING IN HEALTHCARE WORKERS: A UK EXPERIENCE

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RATIONALE: Screening programmes for Tuberculosis (TB) have been widened from detecting early active TB to identifying Latent Tuberculosis Infection (LTBI) and providing subsequent preventive chemotherapy. Health care workers (HCW) have been shown to have a higher risk of tuberculosis and show higher levels of LTBI, compared with the general population. National Institute of Health and Clinical Excellence (NICE) guidelines in the United Kingdom recommend screening for TB in new entrants to the National Health Service (NHS). Factors that limit the effectiveness of the treatment strategy include the failure of persons with LTBI to accept or complete treatment. An evaluation of the factors that influence treatment outcomes may help to improve the rates of acceptance and completion of treatment for LTBI.

METHODS: Two hundred and forty six new entrant HCW with risk factors for TB were screened pre-employment, for LTBI with Interferon Gamma Release Assay (IGRA) tests. Those with positive IGRA tests were referred to the TB clinic for follow-up and 3-month prophylactic anti-tuberculous therapy. Diagnosis of LTBI was based on a positive IGRA test and a normal chest radiogram.

RESULTS: Forty-four subjects (17.9%) had positive IGRA tests. The prevalence of LTBI was 16.7%. Thirty-three (75%) of those referred, attended the TB clinic. Eleven (25%) did not attend. Twenty-eight of the 33 subjects were offered treatment for LTBI. Twenty-two subjects accepted and 6 declined treatment. Five of the subjects were not offered treatment after evaluation. Twenty-two subjects completed the course of treatment. Only 9 of the 22 subjects had side effects from the treatment for LTBI.

CONCLUSION: Treatment acceptance and compliance rates were satisfactory in this cohort of patients. Side effects of treatment did not impact significantly on compliance. Interventions like education, counselling, support, and possibly directly observed prevention therapy could improve treatment outcomes.

Financial Support: *No Financial support*

SCREENING FOR LATENT TB INFECTION DURING ANNUAL PHYSICAL EXAMINATION AMONG OCCUPATIONAL EMPLOYEES

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RATIONALE: Based on the requirements of work, employees have to engage in congregate living. In this type of condition, once an employee progresses from tuberculosis infection to active tuberculosis, *Mycobacterium tuberculosis* is easily spread from one person to another. TST results are prone to being confounded by the Bacille Calmette-Guérin (BCG) vaccination, and therefore are not suitable in Taiwan. The Food and Drug Administration (FDA) in the United States has certified the use of a third generation diagnostic method – QuantiFERON®-TB Gold In-Tube test (QFT-GIT) – in 2007. Its sensitivity and specificity are much higher than that of TST. This study aims to investigate the rate of latent TB infection and realize risk factors among occupational employees.

METHODS: This study is a cross-sectional study and has been approved by the Institutional Review Board. The study subjects are employees from an occupation. We chose two physical examination hospitals designated hospitals A and B as our area of study. We use structural questionnaires to investigate the risk factors for latent TB infection and collect 3 mls of blood specimen using QFT-GIT to screen a person for latent TB infection.

Statistical analysis utilizes stepwise multiple logistic regression. We discuss the risk factors for the positive results of QFT-GIT after adjusting the potential confounding factors.

RESULTS: The QFT-GIT positive rates were 13% for occupational employees. After adjustment for confounders, this study indicates that women (OR=2.4, 95%CI=1.27-4.53), a TB history (OR=42.88, 95%CI=4.27-430.82), a working location of high TB prevalence area (OR=3.75, 95%CI=2.37-5.95) and smoking (OR=1.82, 95%CI=1.1-3.0) were associated with TB infection among occupational employees.

CONCLUSIONS: Since these occupational employees are 24 hour clustering groups, the senior manager should enforce routine TB screening through the use of QFT-GIT, and promote TB education regularly to prevent the event of TB outbreaks.

Financial Support: *TY099-08*

CONTRAST ECHOCARDIOGRAPHY FOR SHUNT ASSESSMENT IN HEREDITARY HEMORRHAGIC TELANGIECTASIA: IS THERE NEED TO STANDARDIZE PROCESS FOR PATIENT SAFETY?

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Transthoracic contrast echocardiography (TTCE) is an imaging modality used to screen for pulmonary arteriovenous malformations (PAVM's) in Hereditary Hemorrhagic Telengiectasia (HHT). The appearance of contrast media in the left atrium after 4 cardiac cycles on TTCE (Parra J. ERJ, 2010) is indicative of an (extra-cardiac vs intra-cardiac) shunt that is usually related to PAVM's in HHT patients. Respirophasic variations in intrapulmonary pressures can however result in delayed contrast left sided chambers even with patent foramen ovale (Attaran R. Echocardiography, 2006). Hence, repeat injections and larger volumes of air are sometimes required to determine the origin and direction of the shunt by visualization of contrast appearance in the pulmonary veins. While agitated saline with air is the most commonly utilized agent in the clinical practice due to its cost-effectiveness and safety profile when used in the HHT centers with standardized echo protocols, the volume of air injected during TTCE has not been clearly standardized. We present a case of a neurologic complication related to TTCE.

CASE: We report the case of a 41-year-old female with HHT followed by the Edmonton HHT Centre. She was subsequently screened for PAVM's by air Contrast TTCE for PAVM's. She developed Trans neurologic symptoms one minute after the completion of the TTCE (0.5 mL agitated saline with air); the symptoms lasted approximately five minutes.

DISCUSSION: We suggest standardized air contrast with a maximum dose of air contrast (0.1 mL) for HHT screening echos, and *if negative*, a repeat administration of 0.5 mL may increase sensitivity. For individuals with known PAVMs (re-screening), the second administration should be avoided. Additionally, mixing air with 0.5 mL blood (back-flush) can enhance signals with an experienced echocardiographer. TTCE to screen for PAVMs, as recommended in the new international guidelines for HHT (Faughnan M. JMG, 2009) should ideally be performed in echo labs with standardized HHT protocols.

A LATE COMPLICATION OF YESTERDAY'S TUBERCULOSIS MANAGEMENT

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Prior to the advent of effective chemotherapy for tuberculosis, collapse therapy was performed as a curative measure. Complications as a result of this intervention can occur decades after the initial procedure. A 75-year-old ex-smoker presented to the emergency department with progressive shortness of breath, productive cough and weight loss over the last four months. His voice had become hoarse during this time. He had a history of tuberculosis, for which he was treated initially with oral agents in the early 1950s. After spending 2 years in a sanatorium, responding poorly to chemotherapy, he underwent thoracoplasty with resection of the left upper lobe and filling of the collapsed extrapleural space with an inert substance. During his admission, samples of sputum and bronchoalveolar lavage material were sent for cytological examination, Gram stain and culture, Ziehl-Neelsen stain, and culture for acid-fast bacillus, which were all repeatedly negative, except for one positive culture for *Streptococcus constellatus*. The patient received a 2-week course of intravenous antibiotic therapy. Chest radiographs revealed a large, well-circumscribed opacity occupying the majority of the left hemithorax, with mediastinal shift, erosion and remodeling of multiple left upper thoracic ribs. A CT scan of the thorax revealed a large mass occupying the left upper hemithorax, with multiple air pockets within layers of heterogeneous material that were not present on imaging three years earlier. An ultrasound-guided biopsy of the material in the left upper chest revealed fibrinonecrotic debris with a scattered neutrophilic infiltrate. We postulated that the new air pockets represented a possible dehiscence of the plombage with secondary fistula formation. A bronchoplombage fistula may have been the ultimate culprit for the patient's decline. Although uncommon today, late complications should be considered in those who have had plombage surgery performed in the past.

IDENTIFYING MILIARY TB: A CASE-NOTE REVIEW OF ACUTE ADMISSIONS TO UNIVERSITY COLLEGE HOSPITAL, LONDON

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INTRODUCTION: TB incidence is increasing in the UK and the highest rate of incidence is in London. Miliary TB can present with variable symptoms and has a significant mortality rate. HIV is a significant risk factor for miliary TB.

METHODS: We carried out a retrospective analysis of medical records for patients diagnosed with miliary TB at their first acute presentation to University College Hospital, London. Case notes, radiology and microbiology reports were reviewed using a standardised proforma. Twenty cases were eligible for analysis.

RESULTS: The age range was 28-64 years, with 75% of patients aged between 25 and 40 years old.

65% of patients were from Africa, of which 69% were from Central and East Africa.

70% of patients were documented as HIV positive; in 10% of patients HIV status was not recorded. 35% of patients required ITU admission, of which 71% were HIV positive. Only one documented case resulted in death and one had a relapse of disease and required further treatment. Both of these cases were documented as HIV positive.

The majority of patients presented with non specific symptoms of fever (60%) and weight loss (30%).

The majority of patients had evidence of pulmonary infection (80%), 45% had evidence of lymphadenopathy and 20% had evidence of meningitis.

CONCLUSIONS: Miliary TB is a growing international health issue. It is universally fatal if untreated. It should always be considered in the context of vague presentations and symptoms as early diagnosis and intervention can save lives. This case series, carried out at a specialist centre, shows positive outcomes.

Financial Support: *No financial support was received for this case series*

INTENSIVE CARE UNIT RESOURCE UTILIZATION FOR HIGH DOSE INTERLEUKIN-2 THERAPY: A THREE-YEAR EXPERIENCE FROM A LARGE ONCOLOGIC ICU

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RATIONALE: High dose Interleukin-2 therapy (HDIL-2) is commonly used for the management of metastatic melanoma and renal cell carcinoma. However, IL-2 is a potent proinflammatory cytokine and is associated with a sepsis-like syndrome and multiorgan dysfunction. Due to potential need for multiorgan support, HDIL-2 in many centers is

administered as a planned treatment in the Intensive Care Unit (ICU), often resulting in reduced ICU bed resources for the management of critically ill patients. We retrospectively analyzed ICU clinical data for frequency of intensivist intervention in patients receiving HDIL-2, in order to determine whether this treatment can be administered safely in a monitored bed outside the ICU.

METHODS: Following IRB approval, HDIL-2 patients' charts between 01/01/2005 and 12/01/2007 were studied for ICU length of stay (LOS) and the need for intensivist involvement and intervention.

RESULTS: We identified 243 courses (n=122) of HD IL-2 therapy. The median age was 50 yrs (24-71 yrs) and male: female was 2:1, 67% had metastatic melanoma and 33% had renal cell carcinoma. The median ICU LOS was 4.15 days (range 1-14 days). A total of 9 (3%) HDIL-2 admissions needed intensivist intervention in managing organ dysfunction; 7 within four days and 2 after 4 days of ICU stay. There were no deaths related to HDIL-2 toxicity. None needed mechanical ventilation or renal support. The predominant organ dysfunctions included renal and cardiovascular.

CONCLUSION: Intensivist involvement occurred very rarely in patients undergoing HD IL-2 treatment for metastatic melanoma and renal cell carcinoma. This data supports that HD IL-2 can be safely administered outside the ICU, in a setting equipped with cardiovascular and respiratory monitoring devices. Consequent to this study, HDIL-2 therapy in this comprehensive cancer center is now provided in monitored beds outside ICU, resulting in an increased availability of ICU bed resources for patients with multiorgan failure.

Financial Support: *None*

CASE STUDY: A SEVERE CASE OF *MYCOBACTERIUM AVIUM* COMPLEX INFECTION

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The treatment of non-tuberculosis mycobacterial (NTM) infections continues to be a complex and challenging area of respirology. The severity of illness may range from an asymptomatic, indolent infection to a severely debilitating disease. Certainly, there seems to be a significant association between NTM infections and structurally abnormal lungs. This case study is that of a 71-year-old man with a history of severe emphysematous COPD, who was noted to have a questionable lesion picked up incidentally on a CT scan of the thorax. Subsequent imaging revealed the development of several thick-walled cavities, severe destructive changes, and fluctuating areas of consolidation. Due to the suspicion of chronic infection superimposed upon bullous disease, a bronchoscopy was performed to obtain samples. Auramine stain of the lavage fluid revealed 1+ acid-fast bacilli, with subsequent culture positive for *Mycobacterium avium* complex. This patient was then started on standard multi-drug treatment which he remains on more than one year later. Although slight radiographic improvement has been noted, clinically the patient's lung function and exercise tolerance remains severely limited. This case study is just one example of the destructive ability of NTM infections, and the need for a strong index of suspicion, especially in structurally abnormal lungs.

Exercise Physiology / Physiologie de l'exercice

PROPERTIES OF SELF-PACED WALKING: A PATIENT-GOAL ORIENTATED ASSESSMENT

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RATIONALE: Patients with chronic respiratory diseases often have the goal of wanting to walk "for longer". Self paced walking (SPW) is an assessment whereby patients are asked to walk continuously for as long as they can at their own pace until intolerance. We determined the properties of a patient-goal orientated assessment; self paced walking (SPW).

METHODS: Patients with symptomatic chronic respiratory disease who were referred for a six-week course of PR were screened for eligibility. At enrolment to PR (baseline) the following assessments were conducted: i) two SPW with both time and speed measured; ii) two six minute walk tests (6MWT); iii) the Medical Research Council (MRC) dyspnea scale grade. Upon program completion two SPWs and one 6MWT were again performed. The validity, repeatability and responsiveness of the SPW were assessed.

RESULTS: Of the 124 patients screened 64 participated (44% male, 81% had COPD, mean [SD] age 66.9 [8.4] yrs, FEV_1 45 [23] %predicted, FEV_1/FVC 46[21]%, BMI 28 [9] $kg \cdot m^{-2}$). 50 and 37 patients completed two SPWs before and after rehabilitation, respectively. The mean baseline SPW speed, but not time, was negatively correlated to the MRC dyspnea grade (r=-0.54 p<0.001 and r=-0.20 p=0.19, respectively). The mean SPW time increased on the second day of testing from 15.1 to 17.9 min ($F_{1,30}$ = 4.62; p=0.004) and the effect of test day was unaltered after PR ($F_{1,30}$ = 0.07; p=0.80). The coefficient of repeatability for SPW time was 16.1 min. Both mean [95% CI] SPW time and speed increased after rehabilitation (10.6 [6.6 to 14.5] min p<0.001, *d*=0.95 and 3.5 [1.3 to 5.7] $m \cdot min^{-1}$ p<0.001, *d*=0.23, respectively).

CONCLUSION: The self paced walk has discriminative validity and is highly responsive to the effects of PR. The variability in SPW time makes it better suited to interpreting group rather than individual changes.

Financial Support: *An unrestricted grant from AstraZeneca*

EFFECTS OF HEALTHY AGEING AND MILD COPD ON EXERTIONAL DYSPNEA IN WOMEN

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RATIONALE: When the ventilatory and mechanical abnormalities of mild COPD are added to the normal effects of aging, women with a naturally reduced ventilatory reserve may experience greater dyspnea during a standardized physical task than men. The purpose of this study was to evaluate the physiological basis for sex-differences in exercise-induced dyspnea in patients with mild COPD and in healthy age-matched controls.

METHODS: We compared operating lung volumes, breathing pattern and dyspnea ratings during symptom-limited incremental cycle exercise in 32 well-matched men (FEV_1=86±10% predicted) and women (FEV_1=86±12% predicted) with mild COPD and 32 healthy age-matched controls (16 males, 16 females).

RESULTS: There were no sex differences in dyspnea intensity in the healthy control group at any work rate or ventilation. In the COPD group, breathlessness/ventilation slopes were 41% greater in women than men but were not significantly different when ventilation (VE) was normalized to the predicted maximal ventilatory capacity (VE/MVC). Furthermore, at 80 watts, dyspnea ratings were 5.7±2.3 and 3.3±2.5 Borg units (*P*<0.05) and the VE/MVC ratio was 72% and 55% in women and men, respectively (*P*<0.05). Mean reduction in inspiratory capacity from rest to peak exercise was 16% in both women and men with COPD. However, this reduction occurred over a much narrower range of increasing VE in women (change in VE=35±10 L/min) compared with men (change in VE=61±23 L/min) (*P*<0.001). Women with COPD had a lower inspiratory capacity and reached critical mechanical constraints on tidal volume expansion at a lower work rate and ventilation than men: this coincided with an earlier rise in dyspnea to intolerable levels.

CONCLUSIONS: Women with mild COPD consistently reported greater dyspnea for a standardized work rate than men. This disparity was explained by a relatively higher ventilatory demand-capacity ratio for a given work rate and an earlier onset of dynamic respiratory mechanical constraints in women.

Financial Support: *William M Spear/Richard K. Start Endowment Fund for Respiratory Research at Queen's University, GlaxoSmithKline and an Ontario Thoracic Society Grant in Aid*

A COMPARATIVE PILOT STUDY OF THE EFFICACY OF THREE PORTABLE OXYGEN CONCENTRATORS DURING A SIX-MINUTE WALK TEST IN PATIENTS WITH CHRONIC LUNG DISEASE

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RATIONALE: Portable oxygen concentrators (POCs) featuring the latest integrated oxygen conserving devices enhance patient mobility during ambulation. Little research is available on the clinical performance of the latest POCs with regard to their ability to maintain patients' oxygen saturations ≥90 % during exercise. The purpose of this study is to compare the efficacy of three POCs, with maximum oxygen production capabilities of 950 to 3000 ml per minute, in maintaining oxygen saturations ≥90 % in patients with chronic lung disease [Chronic Obstructive Pulmonary Disease (COPD) or Pulmonary Fibrosis (PF)] during exercise.

METHODS: Six minute walk tests (6-MWTs) were administered while monitoring oxygen saturations by pulse oximetry (SpO_2) in 10 patients with documented exertional oxygen desaturations of ≤85% on room air. A control walk was performed with the participants' current oxygen system set at their prescribed exertional flow rate. The participants then performed a 6-MWT with each of the three POCs set at the maximum pulse dose setting. The POCs were randomly assigned using a sequence generator. Statistical analysis was performed using SPSS Version 18 for Windows using a one-way ANOVA and Tukey's Post-Hoc.

RESULTS: 10 patients (5 male, 5 female, average age 69.6±6.5 years-old) were included, nine of whom had COPD and one patient who had PF. On average, the Eclipse 3 resulted in the highest oxygen saturation at each time point (Table 1). This corresponded with increased total time and total distance walked. However, only significant differences in oxygen saturation (at end-exercise) existed between the Eclipse 3 and the iGo (p=0.032).

TABLE 1

Average (n=10) measures for each trial

Measure (mean ± SD)	Control	Evergo™	Eclipse 3™	iGo™
Pre-Exercise SpO_2 (%)	94.5±2.3	95.1±3.7	98.3±2.0	94.8±3.0
End-Exercise SpO_2 (%)	85.±3.5	87.6±4.4	92.6±7.0†	86.2±4.1
Total Time (min)	3:59±1:58	4:30±2:22	5:06±1:32	4:02±2:06
Total Distance (m)	219.4±125.7	232.6±136.6	262±96.9	212.4±125.2

†p=0.032 between end SaO_2 Eclipse vs. iGo

CONCLUSIONS: All POCs demonstrated increased oxygen saturation during exercise compared to the control but only the Eclipse 3 resulted in adequate oxygen levels.

Financial Support: *Institute for Rehabilitation Research and Development, The Ottawa Hospital Rehabilitation Centre*

$FREEO_2$: CLOSED-LOOP ADAPTATION OF OXYGEN FLOW BASED ON SPO_2 EVALUATION IN HEALTHY SUBJECTS WITH INDUCED HYPOXEMIA

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RATIONALE: It has been shown that SpO_2 values above or below recommended target is frequent with potentially harmful consequences. We developed a new system ($FreeO_2$) that automatically adjusts the oxygen flow to maintain SpO_2 in a predefined target. We have evaluated this system in healthy subjects with induced hypoxemia.

METHODS: Hypoxemia was induced in 10 healthy subjects breathing a gaz mixture (air + nitrogen) with FiO_2 progressively decreased from 21 to 7%. Each subject blind for the condition was submitted in a random order to 3 conditions during induced hypoxemia: (i) no additional oxygen (ii) oxygen with a constant flow (1.5 L/min) (iii) oxygen with $FreeO_2$ (variable flow). Oxygen flow, SpO_2, $EtCO_2$, respiratory rate, and pulse rate were recorded each second. The primary outcome was the time with SpO_2 between 92 and 96%.

RESULTS: The SpO_2 target (92-96%) was achieved in 27.8, 36.7 and 67.4% (p<0.001) of the time with no oxygen, constant oxygen and $FreeO_2$. Severe desaturations (SpO_2 <88%) were respectively observed in 34.5, 12.8 and 2.3% of the time (p<0.001). Hyperoxia was present in 6.1, 37.1 and 15.3% of the time with no oxygen, constant oxygen and $FreeO_2$, respectively (p<0.001). Tachycardia was present without oxygen and with constant oxygen flow but not with $FreeO_2$ (Figure). These results were obtained with a mean flow of 1.27 L/min. The maximum flow with $FreeO_2$ was 7.6 L/min.

CONCLUSION: In this model of induced hypoxemia in healthy subjects, the $FreeO_2$ system performed better than no oxygen or oxygen delivered with a constant flow. The system maintained the subjects within the SpO_2 target, significantly reduced the frequency of severe hypoxemia and of hyperoxia. Also, with the $FreeO_2$ system, no reflex tachycardia occurred. These results were obtained with a mean flow of 15% lower than the constant flow of 1.5 L/min.

Financial Support: *FRSQ, Canadian Foundation for Innovation, Oxynov*

REDUCTION OF THE OXYGEN CONSUMPTION WITH AUTOMATED TITRATION ($FREEO_2$)

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RATIONALE: Recent data demonstrate that high oxygen target may be harmful in several clinical situations. The aim of the study was to evaluate the oxygenation target used by physicians and to demonstrate the potential advantage to use automated adjustment of oxygen flow.

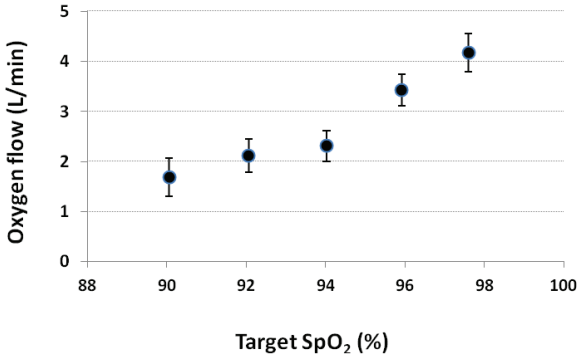
METHODS: We first conducted an observational study in three Canadian hospitals to evaluate the SpO_2 target. During one day, investigators collected in all hospitalized patients how frequently oxygenation status was monitored, the level of SpO_2, the oxygen flow used as well as patient's characteristics.

In the second part of the study, we evaluated the potential for oxygen sparing with a new device that automatically titrates oxygen ($FreeO_2$). Healthy subjects had induced hypoxemia leading to baseline SpO_2 below 90%. Different SpO_2 targets were set with the $FreeO_2$ device and oxygen flow required to attain the different targets was evaluated.

RESULTS: The number of patients receiving oxygen/number of hospitalized patients was 9/83 (10.8%), 23/250 (9.2%) and 87/287 (30.3%). Among patients receiving oxygen, 11, 30 and 33.3% had continuous SpO_2 monitoring. The median (25-75) number of daily SpO_2 (%) recorded by the nurses was 6(3-8), 8(8-24) and 6.6(3-24). The median (25-75) SpO_2 was 94(93-96), 96(94-98) and 96(93-97). Median (25-75) oxygen flow (L/min) was 2(1-2.5), 2(1-4) and 3(2-4).

In the first 5 healthy subjects with induced hypoxemia, SpO_2 target of 94% required 2.3±0.3 L/min of oxygen while a target of 96% required 3.4±0.3 L/min. Relation between SpO_2 target and oxygen flow is shown on the figure.

CONCLUSION: Less than 1/3 of the hospitalized patients received oxygen with continuous monitoring. This may explain the relatively high SpO_2 targets chosen by the clinicians. With a lower target (94%), oxygen consumption may be reduced by 33%. These targets can easily be obtained with automated systems.



Financial Support: *FRSQ, Canadian Foundation for Innovation, Oxynov*

FREE O_2: CLOSED-LOOP AUTOMATIC TITRATION OF OXYGEN FLOW BASED ON SPO_2 EVALUATION IN COPD PATIENTS DURING ENDURANCE SHUTTLE WALKING

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RATIONALE: Long term oxygen therapy is used at home in COPD patients. In spite of oxygen therapy, desaturations occur frequently during exercise, during the night and even at rest. Oxygen flow is usually set at a fixed rate in ambulatory patients. We developed a new closed-loop system ($FreeO_2$) that automatically adjusts the oxygen flow to patient's needs based on the SpO_2, $EtCO_2$ and respiratory rate. The aim of this study is to evaluate this system in COPD patients during endurance shuttle walking.

METHODS: We are recruiting 10 COPD patients exhibiting O_2 desaturation on exertion. 5 visits are planned with a minimum of 48 hours between each visit. First visit is intended to perform an incremental shuttle walking test (ISWT). During the second visit, patient is trained to perform an endurance shuttle walking test (ESWT) at an intensity representing 85% of the peak VO_2 as predicted from the ISWT. At visits # 3, 4 and 5, one ESWT is performed in a blinded and random order with one of the following conditions: 1) air at a fixed flow of 2 L/min; 2) oxygen at a fixed flow of 2 L/min; 3) $FreeO_2$ (variable oxygen flow). After the ESWT, a 10-minute recovery period is planned. SpO_2, pulse rate, $EtCO_2$, respiratory rate and oxygen flow are continuously recorded with the $FreeO_2$ system.

RESULTS: We present the results of the first 6 recruited patients. The mean patient age was 68±6 years and mean FEV_1 was 1.3±0.3 L (54±11% predicted). Main results are presented in the table. SpO_2 and oxygen flow during the 3 study periods are presented in the figure for patient # 1.

	Minimum SpO_2 (%)	% of time with SpO_2<88%	% of time with SpO_2 >96%	% of time with SpO_2 92-96%	Duration of the effort (s)	Walking distance (m)	P (Friedman)
AIR (2L/min)	77.7±4.0	48.6±18.4	10.0±17.2	20.1±15.7	663±124	640±100	<0.01
O_2 (2L/min)	81.0±4.3	34.2±19.4	23.6±30.0	30.2±14.0	580±102	600±126	<0.01
$FreeO_2$	88.8±1.5	0.7±0.9	17.1±10.2	50.3±23.2	1068±315	1180±510	<0.01

CONCLUSION: Automatic titration of oxygen flow during walking may improve oxygenation during daily activity such as walking in patients with COPD in comparison to room air and fixed oxygen administration.

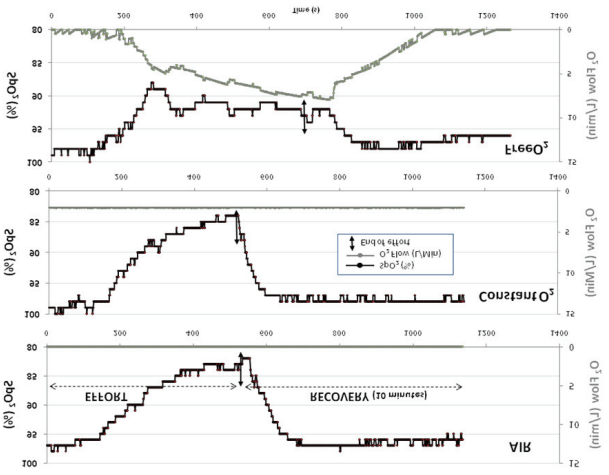

Figure) *SpO_2 (black line) and oxygen flow (grey line) during effort and during the recovery phase.*

Financial Support: *FRSQ, Canadian Foundation for Innovation, Oxynov*

PHYSIOLOGICAL CORRELATES OF HIGH-LEVEL FUNCTIONAL PERFORMANCE IN COPD

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RATIONALE: Performance of functional activities that require a high level of whole body energy utilization are typically not performed by patients with COPD due to ventilatory and/or muscular limitations. As a result, these patients have reduced functional performance; however, the physiological parameters that contribute to this reduced performance are unknown. The aim of this study was to determine the relationship between high-level functional performance, leg muscle strength/power, aerobic power, and anaerobic power.

METHODS: 11 patients with COPD (FEV_1 46±15% predicted) completed pulmonary function testing, a cardiopulmonary exercise test, leg extension isokinetic dynamometry (isometric peak torque (IsoPT) and rate of torque development (IsoRTD), concentric peak torque at 90, 180, and 270°s^{-1}, and eccentric peak torque at 90°s^{-1} (EccPT)), a steep ramp (SR) anaerobic cycle ergometry test (increments of 25W$10s^{-1}$), and three functional measures (timed up and go (TUG), timed stair climb (SC), and 30 second sit to stand (STS)).

RESULTS: TUG time correlated significantly ($p<0.05$) with the SR power output ($r=-0.71$), IsoPT ($r=-0.89$), and EccPT ($r=-0.78$). Multiple regression ($R^2 = 0.79$) revealed IsoPT as the most significant predictor of TUG time. SC time correlated significantly with the SR power output ($r=-0.91$) and IsoRTD ($r=-0.78$). Multiple regression ($R^2=0.87$) revealed only SR power output as a significant predictor. STS time correlated only with the SR power output ($r=-0.67$).

CONCLUSIONS: Performance on the SR test is reflected in all three functional tests. In addition, performance on the TUG is predicted by isometric and eccentric strength; whereas performance on the SC reflects the speed of muscle contraction. Enhancement of anaerobic power and leg muscle strength through focused rehabilitation may increase the ability of patients with COPD to perform higher level functional tasks.

Financial Support: *Canada Foundation for Innovation, Royal University Hospital Foundation, Canadian Lung Association*

FIELD TESTS ELICIT SIMILAR OXIDATIVE AND CARDIAC DEMANDS AS CYCLE ERGOMETRY TESTS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE

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RATIONALE: Field walking tests are commonly used by clinicians to test exercise capacity in patients with COPD. It would be useful to know to what extent these tests stress the cardiovascular system.

AIMS: To compare peak cardiorespiratory responses during the six-minute walk test (6MWT), incremental shuttle walk test (ISWT) and endurance shuttle walk test (ESWT) with those elicited during an incremental cycle ergometry test (CET) in patients with COPD.

METHODS: 24 patients (FEV_1 51±14%; 15 men) completed 4 assessment sessions, separated by ≥24 hours. During an individual session, the patient completed either two 6MWTs, ISWTs, ESWTs or a single CET, wearing a portable gas analysis unit (Cosmed™ K4b^2) which included continuous measures of heart rate and arterial oxygen saturation (SpO_2).

RESULTS: Compared with all field walking tests, the CET elicited a higher peak rate of carbon dioxide output (1173±350 ml/min^{-1}; $F_{3,62}$ = 4.8; p=0.006), minute ventilation (48±17 L/min^{-1}; $F_{3,69}$ = 10.2; p<0.001) and a higher end-test SpO_2 (95±4%; $F_{3,63}$ = 25.3; p<0.001). No difference was observed between tests in the peak rate of oxygen uptake ($F_{3,69}$ = 1.2; p=0.33), end-test heart rate ($F_{2,50}$ = 0.5; p=0.61) or tidal volume ($F_{3,69}$ = 1.7; p=0.18).

CONCLUSION: Standardized field walking tests elicited similar oxidative and cardiac demands as a laboratory-based CET, suggesting that these tests can be used to prescribe training intensities during pulmonary rehabilitation.

Financial Support: *Physicians Services Incorporated Foundation. Dr. Brooks is supported by a Canadian Research Chair and Dr Goldstein by the NSA Chair in Respiratory Rehabilitation Research*

DEVELOPMENT OF A SUPRAMAXIMAL INTERVAL EXERCISE PROTOCOL IN PATIENTS WITH COPD: EFFECTS ON WORK PERFORMED AND VENTILATORY LIMITATIONS

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RATIONALE: Patients with COPD are often limited by an inability to increase ventilation to meet the metabolic demands of exercise. Heliumhyperoxia (HeHOX; 70% He, 30% O_2) delays ventilatory limitations and improves exercise performance. The purposes of this study were to: a) compare physiological responses and work performed during high-intensity interval (HII) and constant work rate (CWR) exercise, and b) examine the effect of HeHOX on performance during each mode of exercise.

METHODS: 5 patients with COPD (FEV_1 55±14% predicted) completed a cardiopulmonary exercise test (CPET), a steep ramp (SR) anaerobic cycle ergometry test (increments of 25W10s^{-1}), two CWR trials (80% of CPET peak work rate; mean 58W) breathing either room air (CWR-A) or HeHOX (CWR-H), and two HII trials (repeats of 30s at 70% of SR peak work rate (mean 101W) followed by 90s at 20% of CPET peak work rate) breathing either room air (HII-A) or HeHOX (HII-H).

RESULTS: End-exercise values for V_E, HR, dyspnea, and leg fatigue were not different between trials. HII was conducted at a lower average work rate than CWR (36 vs. 58W); however, subjects performed HII-H longer (781 vs 192 and 305s, respectively) and for greater work (32644 vs. 11277 and 18802J, respectively) than both CWR-A and CWR-H. In addition, there was an increase in total work performed during HII-A (21508J) compared to CWR-A. HeHOX resulted in a greater relative increase in the total work performed during the CWR trials than that HII trials (96% vs. 65%), suggesting that HII was less limited by ventilatory demands than CWR, despite similar end-exercise ventilatory constraints.

CONCLUSIONS: This HII protocol results in greater leg muscle work performed and less ventilatory limitation than constant work rate exercise. This new protocol may result in greater physiological change with training; however, this suggestion requires further study.

Financial Support: *Saskatchewan Health Research Foundation, Canadian Lung Association*

Pediatrics /Pédiatrie

ALVEOLAR NITRIC OXIDE CONCENTRATIONS ARE INCREASED IN IMMUNOCOMPROMISED CHILDREN FOLLOWING SOLID ORGAN TRANSPLANTATION

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RATIONALE: Upper airway nitric oxide (NO) levels have recently been reported to be decreased in immunocompromised children following solid organ transplantation (Grasemann et al, JHLT 2010). Fractional exhaled NO (FENO) measurements at multiple flow rates can be used to determine flow-independent airway NO parameters, including bronchial NO flux (JNO) and alveolar NO concentration (Calv). This study was carried out to determine flow-dependent and flow-independent airway NO parameters in pediatric transplant recipients.

METHODS: Patients were recruited during routine pulmonary function testing. After obtaining informed consent, subjects underwent FENO measurements at various flows (50, 100, and 150 mL/sec), and nasal NO measurements, using published standard procedures. JNO and Calv were then determined for each subject. Comparisons were made between the transplant population and healthy controls using the Mann-Whitney U test.

RESULTS: Eight cardiac transplant recipients and 22 controls were included thus far. Mean (±SD) age of the transplant recipients was 13.9±2.0 years, and controls were 11.7±3.9 years old at the time of study. The time from transplant was 46.0±32.6 months. FEV_1 was similar between groups (93.1±13.2 vs. 96.4±12.9 % predicted), as was FVC (90.0±13.9 vs. 94.3±12.0 % predicted).

There were no differences between groups in nasal NO (849±346 vs. 960±310 ppb, p=0.4), FENO at 50mL/sec (14.7±8.0 vs. 10.8±3.9 ppb, p=0.4) or JNO (469.4±279.2 vs. 438.6±180.3 pl/sec, p=0.9). In contrast, Calv was significantly increased in transplant patients (5.5±4.0 vs. 1.6±0.8 ppb, p<0.01).

CONCLUSIONS: This study demonstrates an increase in alveolar NO concentration in pediatric transplant recipients. Upper airways NO, standard flow FENO, and JNO were not different from controls, suggesting an increase in NO production in the peripheral airways only.

Financial Support: *SickKids Transplant Centre, Ontario Thoracic Society*

HIGH PHYSICIAN ADHERENCE TO PHENOTYPE-SPECIFIC ASTHMA RECOMMENDATIONS BUT LARGE VARIABILITY IN PHENOTYPE RECOGNITION IN CHILDREN

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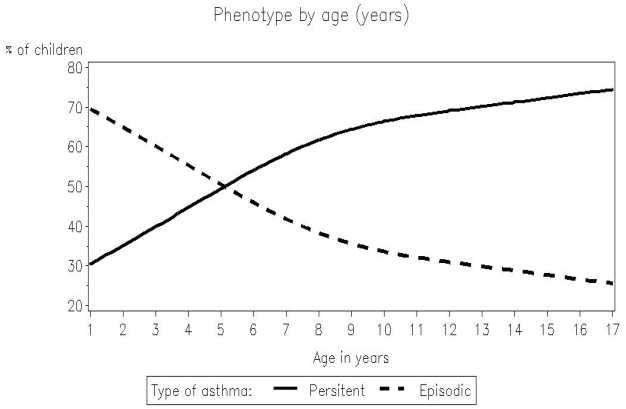
OBJECTIVES: To document physicians' adherence to key elements of the Canadian Asthma Guidelines for children and identify specific challenges regarding the diagnosis, phenotype, and pharmacotherapy.

DESIGN/METHODS: Using detailed electronic health records, we identified a cohort of children aged 1-17 years who presented to tertiary-care paediatric Asthma Centre between 2002-2007, received a diagnosis of asthma by the one of the Asthma Centre physician who cared for at least 100 patients during the study period. The main outcome was

the prescription of maintenance controller medication in children with persistent asthma. Secondary outcomes included conformity of other phenotype-specific guidelines recommendations, diagnosis, and variability and persistence of the phenotype.

RESULTS: The 3490 eligible children (11,119 visits) were seen by one of 10 physicians during the 6-year study period. At the initial visit, 50% of children were deemed to have episodic asthma, 36%, persistent asthma, and 14% had unconfirmed diagnosis. The within-patient asthma phenotype varied over time with a consistency index of 0.76 (best=1). The recognition of persistent phenotype was physician-dependant, varying between 6% and 77% of each practice; it was also significantly positively associated with child's age, (Figure) asthma severity, calendar year, duration of follow-up, and multiple triggers. Among children with persistent asthma, 86% were prescribed a maintenance controller medication; most (58%) received monotherapy, usually inhaled corticosteroids, and 42%, combination therapy, most of which (83%) initiated only after a trial of monotherapy. The majority (65%) of children with episodic asthma were prescribed no daily controller medication.

FIGURE:



CONCLUSION: Physicians are highly adherent to key phenotype-specific pharmacologic recommendations. There is a notable degree of uncertainty in the diagnosis, particularly among young children. The high within-patient and between-physician variation in phenotype appears as the major impediment to adequate management, even in the tertiary care paediatric Asthma Centre.

Financial Support: *Childhood Asthma Foundations*

THE ASSOCIATION BETWEEN MODE OF TRANSPORTATION TO SCHOOL AND ASTHMA IN CHILDREN: ARE CHILDREN WITH ASTHMA MORE LIKELY TO BE DRIVEN TO SCHOOL?

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RATIONALE: There is mounting evidence that traffic-related air pollution (TRAP) is associated with the development of asthma in children. In-cabin air of automobiles and older school buses has been shown to hold high concentrations of TRAP. Recent asthma guidelines encourage children to participate in regular exercise, such as walking to school.

OBJECTIVE: Determine the association between mode of transportation to school and asthma in children.

METHODS: Demographic and health related information from 5619 school children aged 5 to 9 was collected in the 2006 Toronto Child Health Evaluation Questionnaire. Outcome variables were measured by International Study of Asthma and Allergies in Childhood methodology and included current and lifetime doctor-diagnosed asthma, and current wheeze. Mode of transportation was defined as being driven to school by car, or school bus vs. walking. Travel distance between home and school addresses was calculated using CDXZipstream™ and Microsoft MapPoint®. Generalized estimating equations were used to estimate the effect of mode of transportation on asthma outcomes, accounting for possible school clustering effects.

RESULTS: Mean age of participants was 6.7 years, 49.7% were male, and 15.5% reported doctor-diagnosed asthma. Although 79.4% lived within walking distance of school according to board policy (<1.5 km), 54.9% reported walking to school, while 45.1% reported being driven. After adjusting for confounding variables, children driven were more likely to have current asthma (OR 1.27; 95% CL 1.01-1.61), lifetime asthma (OR 1.25; 95% CL 1.02-1.52), and current wheeze (OR 1.19; 95% CL 0.99-1.44) compared to children who walked.

CONCLUSION: Children with asthma in Toronto are more likely to be driven and less likely to walk to school. To better direct public health interventions, future studies should further elucidate the direction of this association, the mechanisms involved, and investigate why children with asthma are more likely to be driven to school. Funding provided by Health Canada.

AUTOMATED PRESSURE TITRATION USING AN AUTOCPAP DEVICE IN CHILDREN WITH SLEEP APNEA

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RATIONALE: Overnight polysomnography (PSG) is the current gold standard test for obstructive sleep apnea (OSA) in children, both for the identification of OSA and for continuous positive airway pressure (CPAP) treatment titration studies. Because of limited availability and high cost of PSG, we wondered if AutoCPAP devices would be an effective way of managing CPAP therapy in children and whether or not this technology could replace the need for a pediatric sleep technologist-performed CPAP titration study?

METHODS: Children with known OSA established on home CPAP treatment who were attending the Pediatric Sleep Laboratory at the Alberta Children's Hospital for the purpose of a follow-up PSG/CPAP titration were invited to participate. Study subjects were prepared for PSG study as described below, using their own CPAP mask with the RemStar AutoCPAP unit replacing the standard sleep laboratory CPAP machine. During the study, the sleep technologist observed respiratory patterns and noted changes in pressure delivered by the RemStar unit. In the event that the RemStar unit did not appropriately respond to the presence of partial or complete airway obstruction, the unit was disconnected and the titration study was completed as per standard laboratory protocol.

RESULTS: To date, two subjects have completed the study protocol using AutoCPAP.

Subject	Peak RemStar	$EtCO_2$ (lowest mean)	Oxygen saturation (highest mean)	AHI
A.N.	5.0-11.8 cmH_2O	58.4 mmHg	94.1%	0.0
C.D.	7.7-11.8 cmH_2O	49.4 mmHg	95.1%	0.0

CONCLUSIONS: Our limited data to date does not support the casual use of AutoCPAP for children with obstructive hypoventilation. The apneas are eliminated by the adjusted pressure but obstructive hypoventilation is not adequately treated. Ongoing evaluation to identify subgroups of children who can be titrated using AutoCPAP is ongoing.

Financial Support: *In part from the Alberta Children's Hospital Foundation and in part from Respironics*

EFFECTS OF RAISED VOLUME RAPID THORACIC COMPRESSION ON SUBSEQUENT MEASUREMENTS OF INFANT FLOW

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RATIONALE: Over the recent years, raised volume rapid thoracic compression (RVRTC) has been used as a measure of change in airway function in infants with lung disease. However, there is limited information available on the effects of RVRTC on lung inflation and subsequent measurements of lung volume. The aim of this study was to assess whether measurements of

functional residual capacity (FRC) by plethysmography or Multiple Breath Washout (MBW) is influenced by prior application of RVRTC in infants.
METHOD: Infants with airway disease (cystic fibrosis or recurrent wheezing) or healthy controls from a longitudinal epidemiological study (CHILD) underwent infant lung function performed under sedation. While ideally paired measurements of MBW and plethysmography should be performed pre-RVRTC and post-RVRTC in the same population, practicalities of length of testing have rendered this unfeasible. The effect of RVRTC manoeuvre on functional residual capacity was therefore assessed using MBW in healthy subjects and by plethysmography in infants with disease. Standardized RVRTC measurement was performed in all infants using the Collins IPL system.
RESULTS: Paired measurements of FRC by plethysmography in 10 infants with airway disease and MBW in 10 healthy subjects pre-RVRTC and post-RVRTC were obtained. All infants were clinically stable and free of acute respiratory infections at the time of study. In the infant group with airway disease, there were no significant differences in the FRC measurement using plethysmography pre-RVRTC (316.2ml±113.4) and post-RVRTC (317.2ml±121) [coefficient variation of 35.85% and 38.13% respectively], p=0.85. Similarly in healthy infants the MBW FRC measurement did not differ pre-RVRTC (157.9ml±33.41) and post-RVRTC (153.1±35.47) [coefficient variation of 21.16% and 23.17% respectively], p=0.43.
CONCLUSION: RVRTC manoeuvres do not influence subsequent measures of lung volume either by MBW or plethysmography.
Financial Support: *Self funded*

Living with Respiratory Disease: Patient and Caregiver Perspectives / Vivre avec une maladie respiratoire: Perspective de patients et de soignants

THE IMPACT OF EDUCATION ON SELF-MANAGEMENT IN A SPECIALIZED GENDER AND AIRWAYS PROGRAM (GAP)

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RATIONALE: The objective of this study was to identify the impact of an interdisciplinary education program, GAP, on the barriers patients face in self-management of airways diseases.
METHODS: Participants used an online platform to complete a questionnaire on their perceived barriers in managing their condition as well as the impact of the action plan and the various educational topics typically covered in the sessions with the educator or physician. They also indicated whether the educational interventions were adequate and a worthwhile investment of their time.
RESULTS: A total of 24 patients completed the survey. Participants were mostly female (78%) and most had a diagnosis of asthma (79%). 66% of the participants identified barriers. For the 24 participants, the most common barriers identified were: being unable to remove triggers from the environment (42%), difficulty remembering to take medications (33%), and feeling unsure they required continuous treatment (21%). Most participants (79%) had heard of the action plan and recalled receiving one. Of those, 84% still had the action plan available and 68% had used it and found it helpful. Education sessions on the proper use of puffers, the respiratory condition and the use of the action plan were most likely to be rated as having significant impact on all measured outcomes and a worthwhile investment of time.
CONCLUSIONS: A large proportion of the participants in a specialized GAP program identified barriers in managing their condition through the use of an online survey. There was individual variance on the impact and value of the educational topics available. The results of this study suggest that it might be worthwhile to offer a questionnaire regarding barriers and educational objectives to patients so that a more tailored, patient-driven, educational experience might be provided.
Financial Support: *None*

"THE THING IN MY NECK": CHILDREN AND YOUTH SPEAK ABOUT LIFE WITH RESPIRATORY TECHNOLOGY

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INTRODUCTION: Very little is known about the perspectives of children and youth living at home with tracheostomies and ventilators. This study was undertaken to provide a venue for children and youth living in midwestern Canada to speak about their experiences.
METHODS: Phenomenological interviews were conducted with six children and youth. Preschool, school-age and late adolescence were represented in the sample. Transcripts were analyzed for recurring themes.
FINDINGS: Several key themes were identified across age groups within the categories of Lived Experience, Patterns of Coping and Relationship. The ultimate goal of normalcy and inclusion was most dominant to all participants. Although most children recognized the essential necessity of technology, one theme experienced by all was they led "A constricted life" within their physical, personal and social domains. Key coping patterns included *being an actor in one's life* (active vs passive), resilience through mobilizing personal agency, accessing social support, and utilizing both problem-based and emotion-focused coping strategies. Patterns of relationship in the realms of family, friends, school and health service providers were also explored through a strengths-based lens, and key themes emerged which included caring, communication, competence, collaboration and trust.
CONCLUSION: Children and youth living with respiratory technology have much to say about their experiences and ways that "work for them" in managing life. Patterns identified included acceptance and integration of their technology into life, including home, school, and social settings; a caring, developmentally appropriate approach by health service providers; opportunities for mastery and control in managing their care; and the presence of supportive relationships with parents, siblings and peers. These patterns should be fostered by health professionals with this population.
Financial Support: *Social Sciences & Humanities Research Council of Canada; Graduate Student Research Scholarship, University of Manitoba*

RIDING THE ROLLERCOASTER: PARENTS DESCRIBE LIFE WITH A CHILD ON HOME VENTILATION AND APPROACHES USED BY HEALTH SERVICE PROVIDERS THAT "WORK FOR THEM"

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INTRODUCTION: Raising a child on home ventilation is challenging. Establishing good working relationships with health service providers is essential to successfully navigate the child's life course. This study was undertaken to reveal parents' perspectives regarding this important relational component of care.
METHODS: Phenomenological interviews were conducted with eight parents who varied as follows: three biological parents, three foster-parents, a stepparent, and a custodial grandparent. Four had been single parents for most of their child's life (age range: three to nineteen years). Transcripts were analyzed for recurring themes.
FINDINGS: Several key themes emerged within and across parenting types/family structures. Single parents reported more social isolation and financial concerns; couples emphasized social inclusion practices and importance of time away (respite) for marital relationship maintenance, while foster parents described financial and emotional challenges of parenting in a dependent context (re: foster agency). All parents strove to provide a normal family life while maintaining their child's health and wellbeing. Pediatric health services played a large role in their lives. Difficulty with accessing the system on an emergent basis was universal; service facilitation via consult with the respirology department was markedly ameliorative. Parents highlighted health service providers' approaches that "worked for them" across the continuum of care as being characterized by: *caring, competence, communication and collaboration, in a climate of understanding and respect that fostered trust*.
CONCLUSION: Parents raising children on home ventilation are dedicated but stressed in managing life's challenges. Health service providers are well situated to make a positive contribution through partnering with parents using an approach that is caring, competent and collaborative.

Financial Support: *Social Sciences & Humanities Research Council of Canada; Graduate Student Research Scholarship, University of Manitoba*

THE EXPERIENCE OF PARENTS AND THEIR CHILDREN WITH NEUROMUSCULAR DISEASE INITIATING NON-INVASIVE POSITIVE PRESSURE VENTILATION

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RATIONALE: Care of children with neuromuscular disorders (NMD) focuses on prevention and management of disease complications. Non-invasive positive pressure ventilation (NPPV) is used to treat progressive respiratory insufficiency associated with NMD, yet little is known about the impact of NPPV on the family This study explored the experiences of parents and their children with NMD when NPPV is initiated.

METHODS: N=61 children were recruited from two pediatric tertiary centers. Nine children, ages 8-15 years, identified with nocturnal hypoventilation were prescribed NPPV. A mixed method prospective cohort study design included administration of quality of life questionnaires to all participants and semi-structured interviews to those prescribed NPPV.

RESULTS: Preliminary analysis of the questionnaires indicates parents of children on NPPV are up more often at night and are more likely to share a room with their child than controls. Content analysis of qualitative interviews identified that parents experiences with NPPV involve "trying to make it work" and the children s experiences involve "trying to get used to it". Initial expectations and post assessment of intervention outcomes differed for parents and children. Parents had high expectations but reported fewer positive outcomes than anticipated, while children described low expectations yet reported many positive outcomes.

CONCLUSIONS: Use of NPPV for children with NMD can potentially have positive outcomes, yet there are challenges with implementation. Interprofessional caregivers may target strategies to help parents and their children with NMD and nocturnal hypoventilation to anticipate the challenges with initiating NPPV and better support their adaptation to this intervention.

Funding Source: *Canadian Lung Association, Hospital for Sick Children Foundation, Ontario Lung Association*

TREATING REFRACTORY DYSPNEA IN ADVANCED COPD: PATIENT AND CAREGIVER EXPERIENCES OF OPIOID THERAPY

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BACKGROUND: A recent ACCP consensus statement supports the use of opioids for refractory dyspnea in patients with advanced lung disease. Symptom relief is a top priority for patients and families living with advanced COPD but patients' experiences of using opioids for dyspnea is mostly unknown and is the subject of this study.

METHODS: Eighteen participants (patients n=7, all MRC 5) and family caregivers (n=11), were enrolled to this mixed-methods study. Patients (M=5, F=2, mean (SD) age 71(10) had been using opioids for dyspnea for 2.5 months to 4 years. In semi-structured interviews, with patients (P) and caregivers (C) we explored experiences of, and attitudes to, opioid use. Interviews were recorded, transcribed verbatim, coded and analyzed (using interpretive description) for themes emerging from within and across interviews. Participants (n=16, excluding 2 bereaved caregivers) also rated how helpful/unhelpful they found opioids and whether or not they would choose to continue (Y/N).

RESULTS: Patients reported a sense of calm and relief from severe dyspnea. Family caregivers observed marked differences in patients' dyspnea, quality of life, anxiety and depression, noting that patients were breathing more "normally". Their own stress levels fell. All participants chose to continue opioids (P) or supported their use (C). Patients found opioids to be very (n=4) or somewhat helpful (n=3); caregivers observed them to be very (n=7) or somewhat helpful (n=2).

CONCLUSIONS: Opioids added to conventional treatments for advanced COPD were of benefit over the long term to both patients and caregivers.

CLINICAL IMPLICATIONS: Patients and caregivers living with advanced COPD identify relief of dyspnea as a top priority. More extensive research is required to fully understand experiences and effects of opioid therapy for dyspnea refractory to conventional COPD treatment.

Financial Support: *Dr Rocker's research program in advanced COPD is funded by CIHR*

General Poster Display (Non-Moderated) / Le Séance génerale de presentation d'affiches (sans modérateur)

GROWING HEALTHY CHILDREN AND YOUTH: AN ASTHMA EDUCATION PROGRAM

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INTRODUCTION: The Ontario Lung Association (OLA) implemented the "Roaring Adventures of Puff" (RAP), to elementary schools, in collaboration with Public Health School Asthma Program (PHSAP) and First Nation advisors and representatives. The project focused on school aged children with asthma in high risk population. This included the First Nations specifically in Northwestern Ontario communities.

PROJECT DESCRIPTION: This project "Growing Healthy children and youth" intent was to build on established relationship and linkages of the Primary Care Asthma Program site with First Nations communities. Each of the sites chosen to participate all have asthma educators that were trained as "RAP" Instructors to deliver the asthma education program in their community schools.

SETTING: Seven communities from the Sioux Lookout First Nations Community were represented with an average population size of 950, ranging from 150 to 2900. The average number of students that took part in the presentation in the communities was 155.86 and ranged from 47 to 400. For the RAP Session: 70 students participated for whom data were collected; the average age was 8.36 years and ranged from 5-years-old to 11-years-old.

OLA RAP MODEL – THE INTERVENTION TO BE IMPLEMENTED: The OLA RAP model is based on the Alberta RAP model. Materials that were used for the project were evidence based and were culturally adapted in collaboration with the Community Health Directors/Representatives to address the needs of the communities.

PROJECT EVALUATION – PROJECT REACH: The Evaluation of the asthma education program collected the number of project reach. The RAP session also included an evaluative component using the 3 indicators: 1) pre-session *Childhood Asthma Control Test (c-ACT)*, 2) pre and post-session *Inhaler Device Assessment Tool (IDAT)*, 3) post – session Client *Satisfaction Questionnaire for children*.

CONCLUSION: The OLA RAP demonstrated success in improving a) asthma awareness through project reach, b) medication device technique, c) access to an asthma educator and other related respiratory information and materials.

Financial Support: *National Lung Health Framework Phase I/Public Health Agency of Canada*

DALHOUSIE HEALTH MENTORS PROGRAM: LEARNING INTERPROFESSIONALLY ABOUT PATIENTS AND THEIR CHRONIC CONDITION JOURNEY

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The Health Mentors Program was launched at Dalhousie University in September 2010, placing patients at the center of interprofessional

learning about chronic conditions. Approximately 600 students from medicine, physiotherapy, respiratory therapy, nursing, as well as 13 other health professions are learning from people with chronic conditions.

Health mentors are adult volunteers with a chronic condition who share their experience of living with their condition and navigating the healthcare system with a small interprofessional team of four students. Student teams do not provide care, treatment or medical advice; rather, they listen to and learn from the health mentors, who share their distinct perspective. Students ask questions about the health mentor's life story and their chronic condition journey, developing a picture of the whole person. Students share their learning with the mentor to make sure they have understood the mentor's experience, and they finish the year by reflecting on what they have learned.

The biggest challenges facing the program working group are student learning, assessment and supervision, recruitment of health mentors and ensuring that interactions with them are ethical, private and confidential. The logistics of organizing such a complex program in the short time period of four months also called for interprofessional collaboration and resourcefulness.

This first year is a pilot project and preliminary findings about how the program unfolded from the perspective of health mentors, students, faculty supervisors, program organizers, and senior administration will guide future development of the program.

This innovative learning opportunity introduces health professional students to chronic illness and disability, patient-centred care, interprofessional collaboration and the healthcare system they will one day work in. Hopefully, what the students learn from their health mentors will help prepare them to be better healthcare providers.

END-OF-LIFE DISCUSSIONS IN CHRONIC OBSTRUCTIVE PULMONARY DISEASE: A DELPHI STUDY

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Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity worldwide. Patients with COPD in Canada, the United Kingdom and the United States have been shown to have less access to palliative care services than patients with other respiratory diseases such as lung cancer. This is surprising considering that the United Kingdom was rated first, and Canada and the United States were both rated ninth for quality end-of-life care out of 40 countries.

While discussing the end-of-life is difficult for patients and health professionals, it is essential to ensure that the patient's wishes are met, particularly when resources are scarce.

Specialist respiratory nurses with expertise in end-of-life care communication participated in this Delphi study to develop a consensus opinion on end-of-life communication in COPD. Three main issues were investigated: how they know a patient is ready or willing to discuss end-of-life, the key factors involved in such discussions, and the essential content of the discussion.

This consensus opinion can provide guidance for respiratory health professionals who may feel uncomfortable having end-of-life discussions, in order to facilitate effective end-of-life care in COPD.

Financial support: *Provided by the British Lung Foundation*